IRON & COAL

THE IRON AND COAL TRADES' REVIEW

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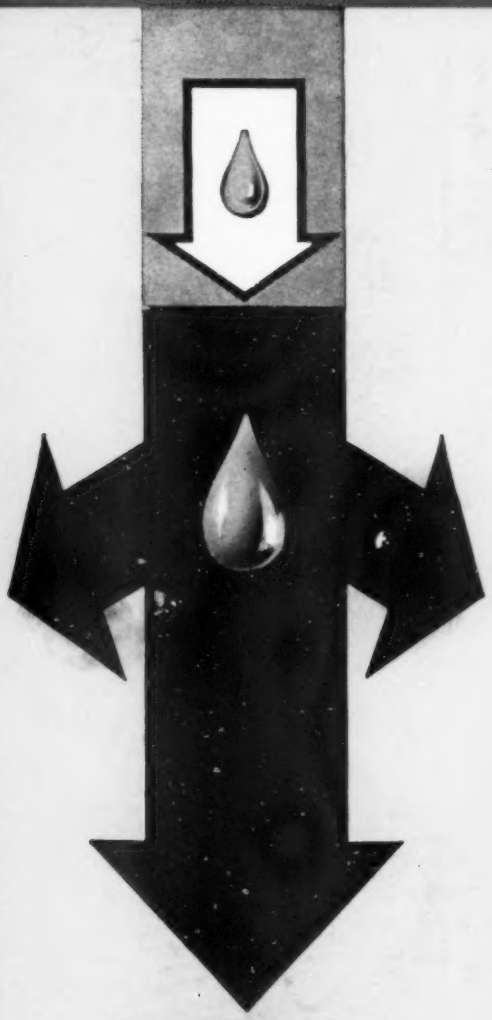

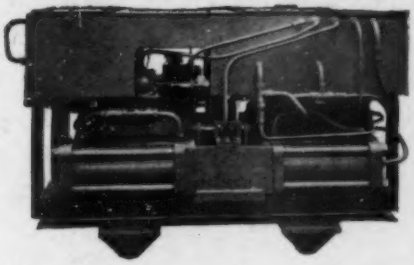

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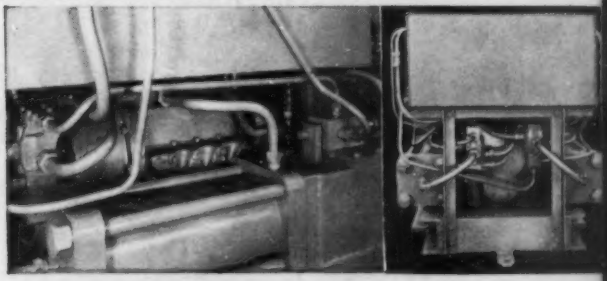

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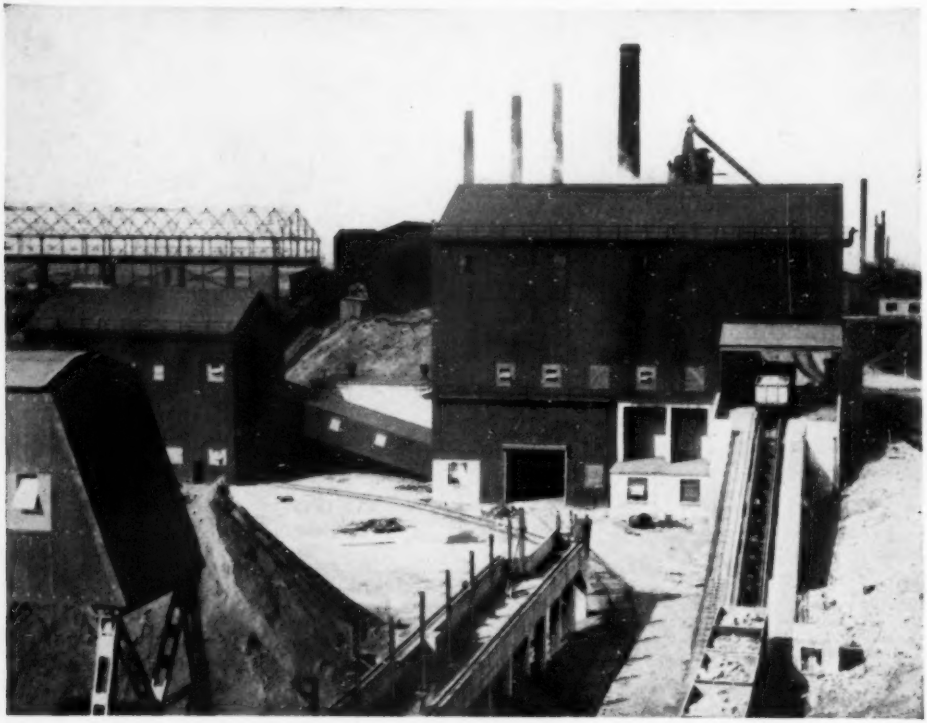

Wagon Haulage, Primary and Secondary Crushing Plants — part of the Ross layout at the West Hartlepool Works of the South Durham Steel & Iron Co. Ltd.

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SPEEDY TUNNELLING

WITH THE SAMSON LOADER

(Top) *Samson loader model MC3 with straight jib, after cleaning up the face of the drift.*
(Bottom) *The loader drawn back from the face.*

In spite of the large size of this Yorkshire drift—16 ft. by 12 ft. finished—
it was driven at unusually high speed and high rate of cubic yards per manshift.
In this a leading part was taken by a Samson Loader.
Its firmness in loading, smoothness in moving, lightness of control,
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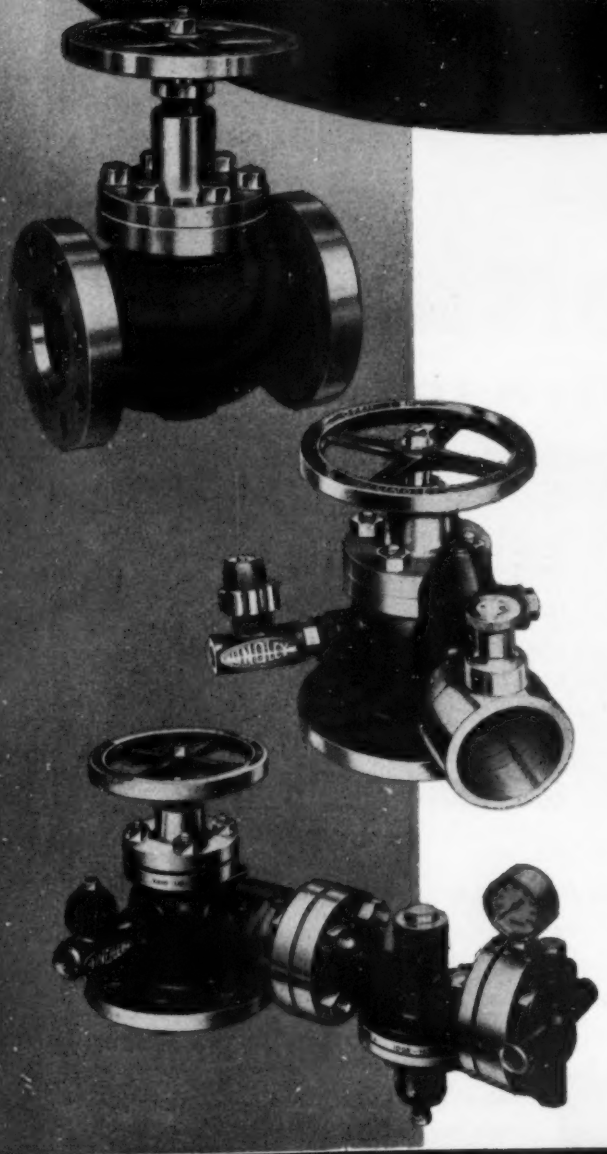

THE LINDLEY "EASY TURN" H.P. STOP VALVE

PROV. PAT. No. 18303/57

Stainless Steel Spindle seat and disc (removable). Easy operation at high pressure. Robust construction throughout. Working pressure 1,500 lb. p.s.i.

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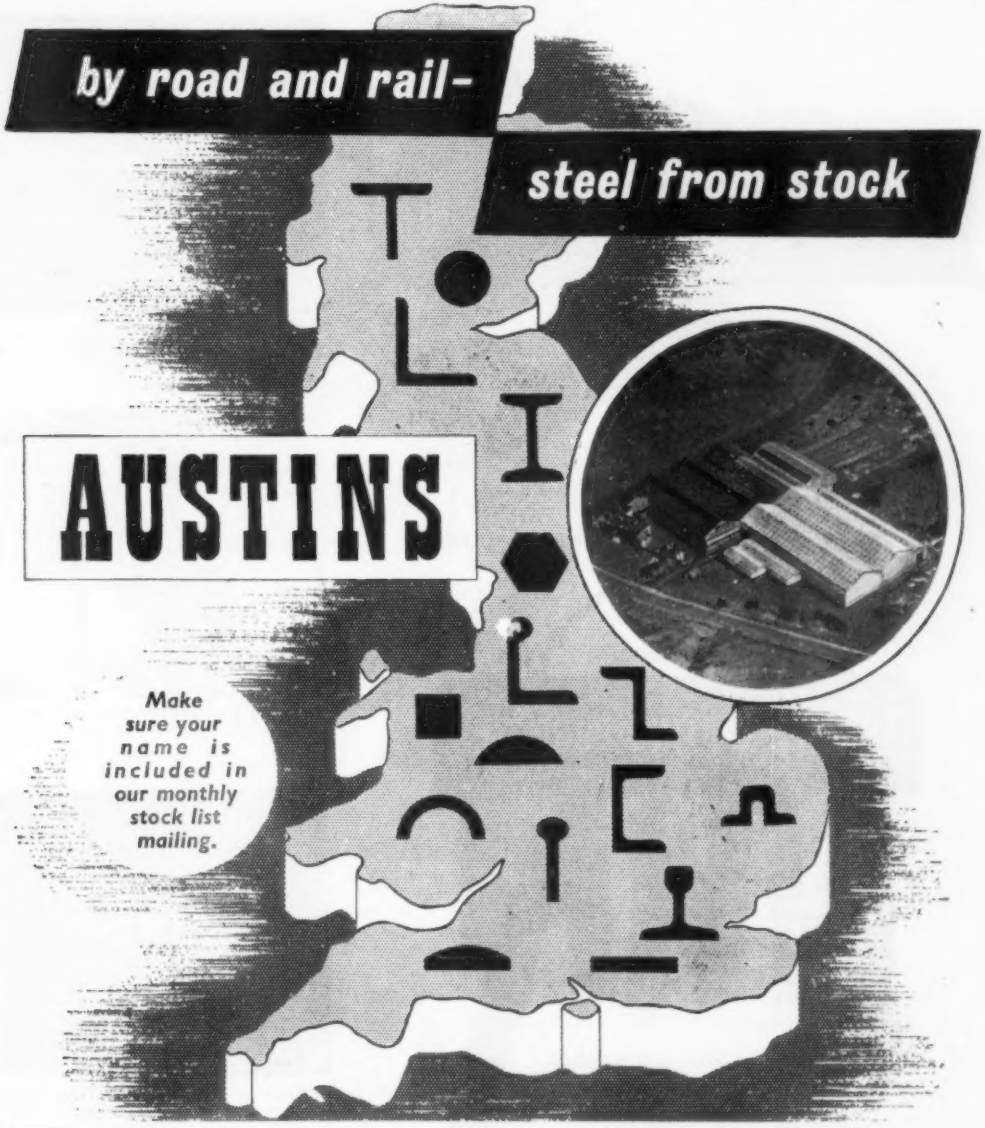

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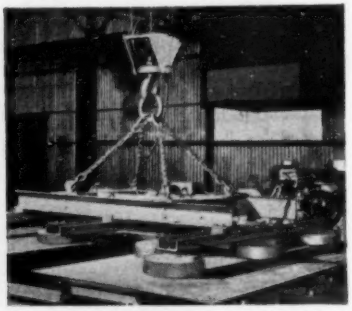
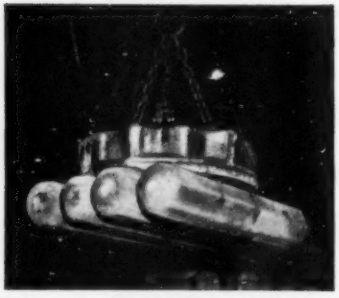


A group of lifting magnets at the Manor Works of Joseph Sankey & Sons handling plates for the magnet yoke of a 7000 MeV proton-synchrotron.

Lifting pig iron at Round Oak Steelworks Ltd.



Lifting four ingots at the works of Taylor Brothers & Co. Ltd., Trafford Park. The total lift is about 13,440 lbs.

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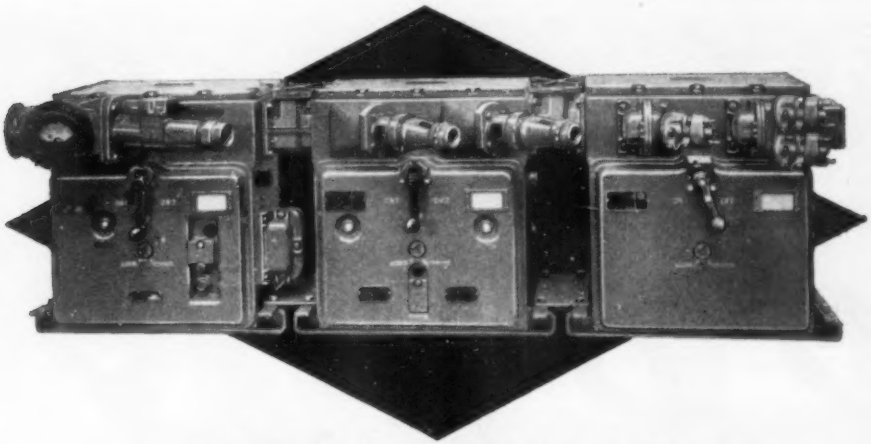

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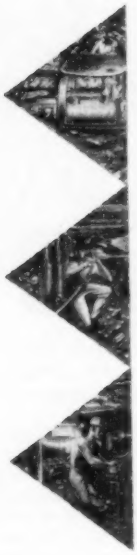

TYPE-SGA8 80-ampere contactor-panel:
NCB Specification: P150/1957

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NCB Specification: P9/1950

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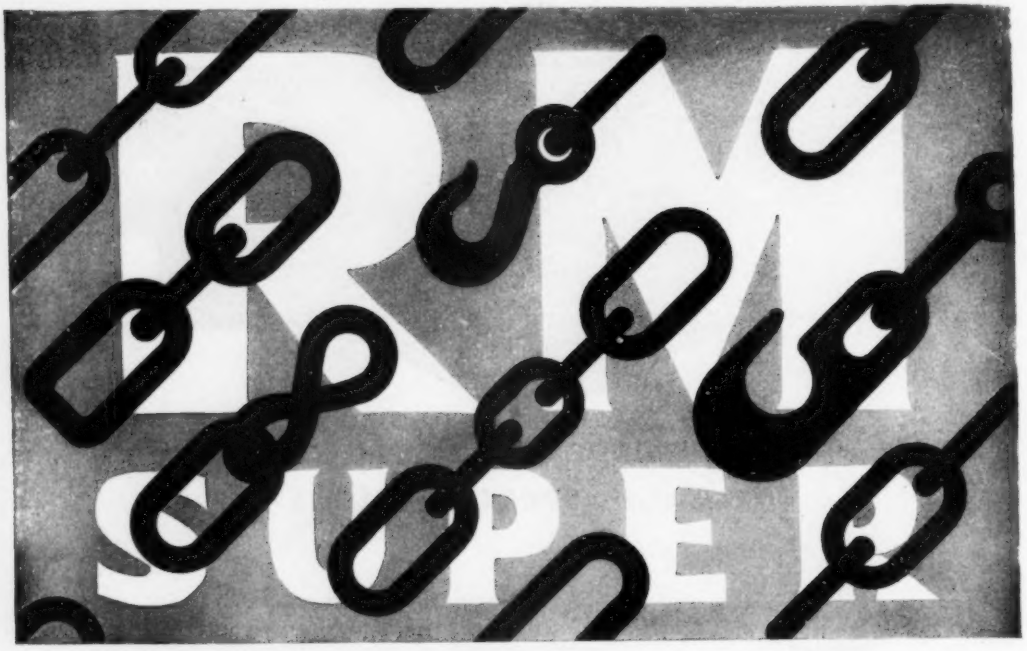

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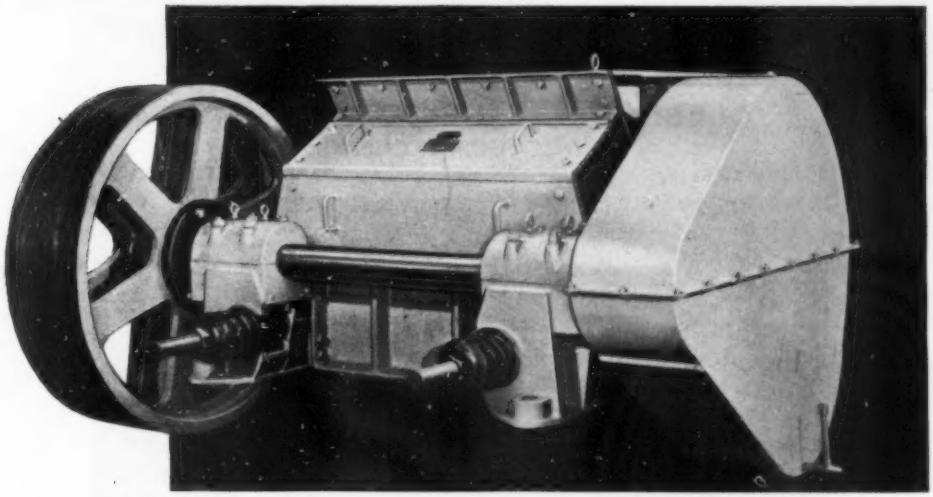

Stag Single Roll Crusher 36" × 36"

The Stag roll crusher is suitable for reducing coal, lump lime, and many other products from large lumps to varying sizes ranging from 6 inches to 1½ inches and under.
The crushers are made in several sizes for use in coal mines and can also be useful where coal is required for mechanical stokers or as a preliminary to further pulverization for powdered fuel for firing boilers and furnaces. The smallest crusher can deal with lumps up to 8 inches in size and the largest will take 20 inches.
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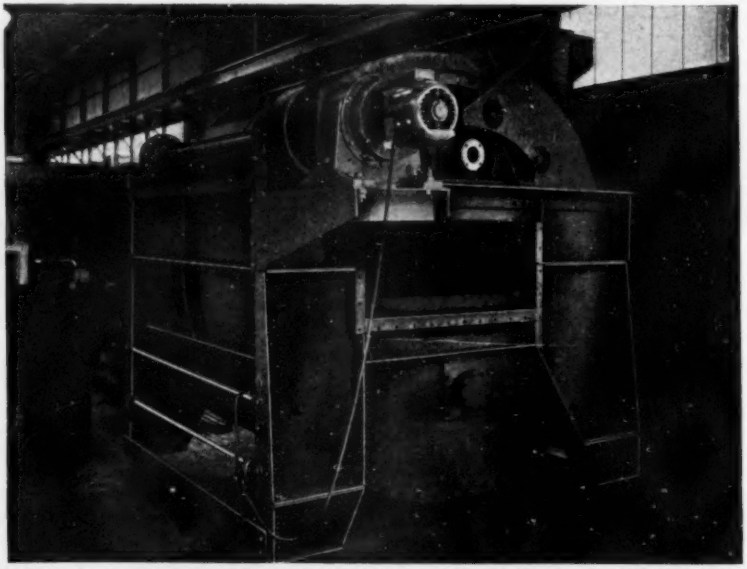

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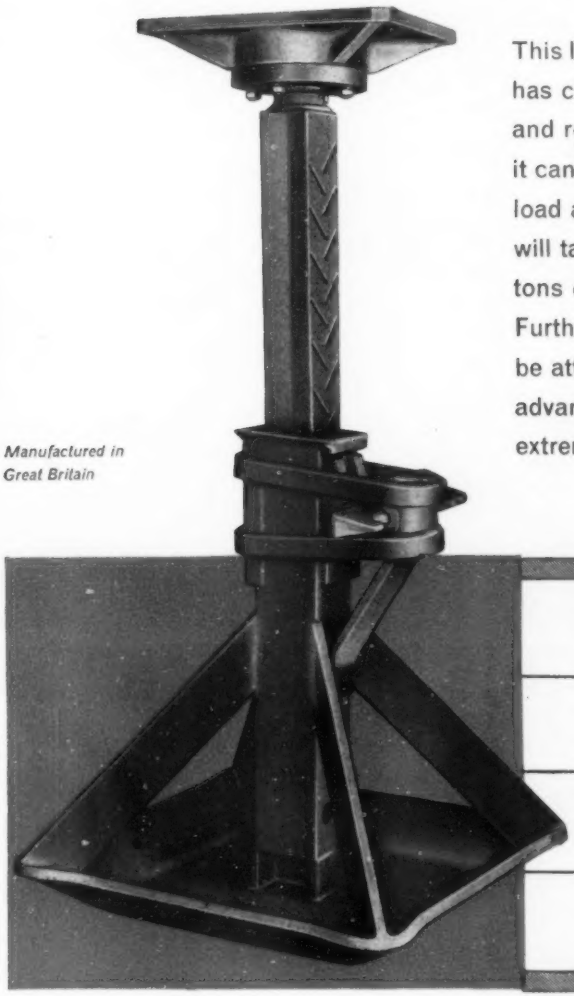

Manufactured in Great Britain

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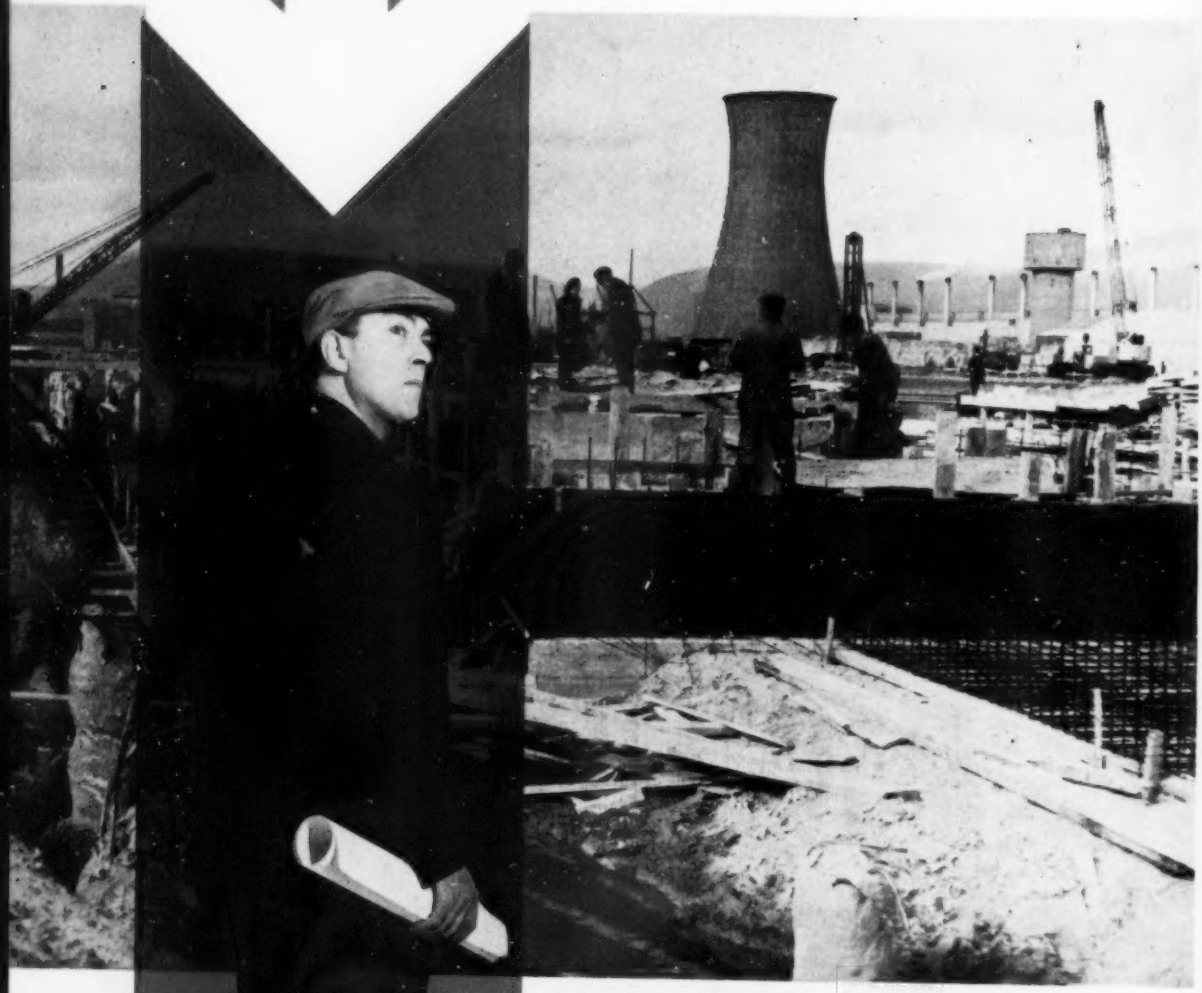

THIS MAN HAS SEEN IT

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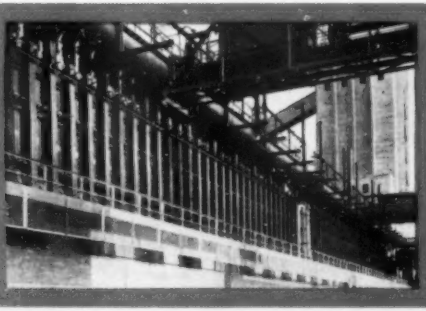

This coke oven and by-product plant was commissioned late in 1959 at the Abbey Works of the Steel Company of Wales. The 80 ovens supply 930 tons of coke each day to the blast furnaces.

INDIA

As a member of the British Consortium building the Durgapur Steelworks in India, one of Simon-Carves' jobs is the design and construction of the complete coke oven and by-product plant. This is No. 1 battery just before it was commissioned.

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More than 2600 tons of coal each day will be the throughput of this large installation Simon-Carves are building in Australia. The two 48-oven batteries, the complete by-product plant and the crude benzole and benzole rectifications plants are included in the contract.

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All coking plants look something like this during construction. To the uninitiated, it may appear to be an untidy jumble of earthworks and concrete, but this experienced site engineer sees only the sturdy lines of another huge Simon-Carves coking plant taking shape. You have to be interested in steelworks coking plants for a job like this, but if you are then Simon-Carves is your firm. Plants are going up at steelworks in Australia, India and Britain, each one specially designed to suit the individual requirements of a particular steelworks.

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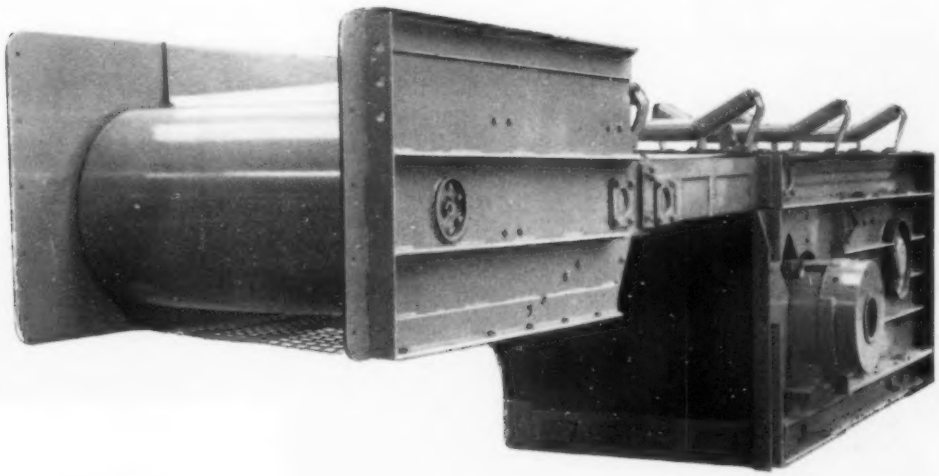

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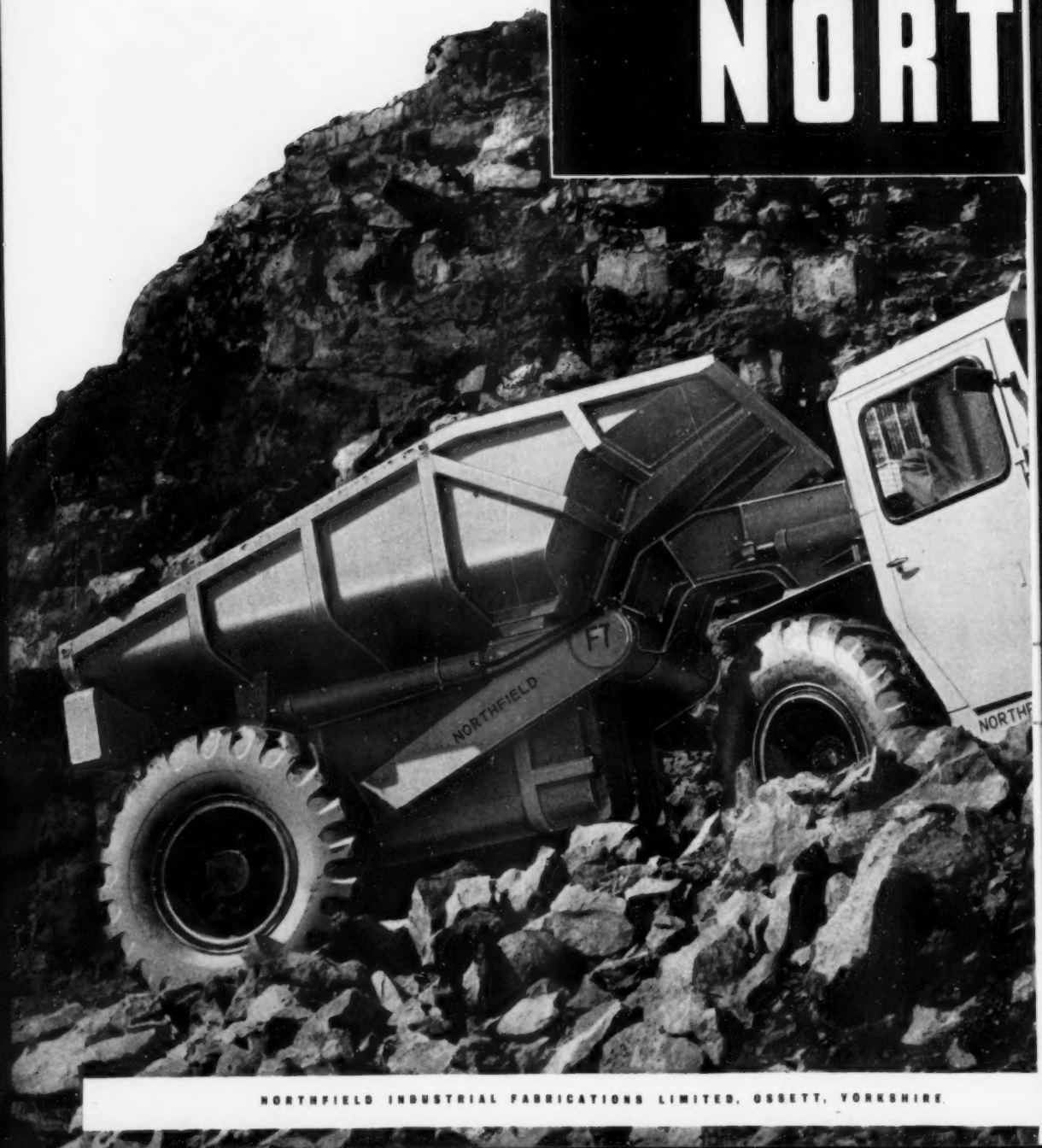

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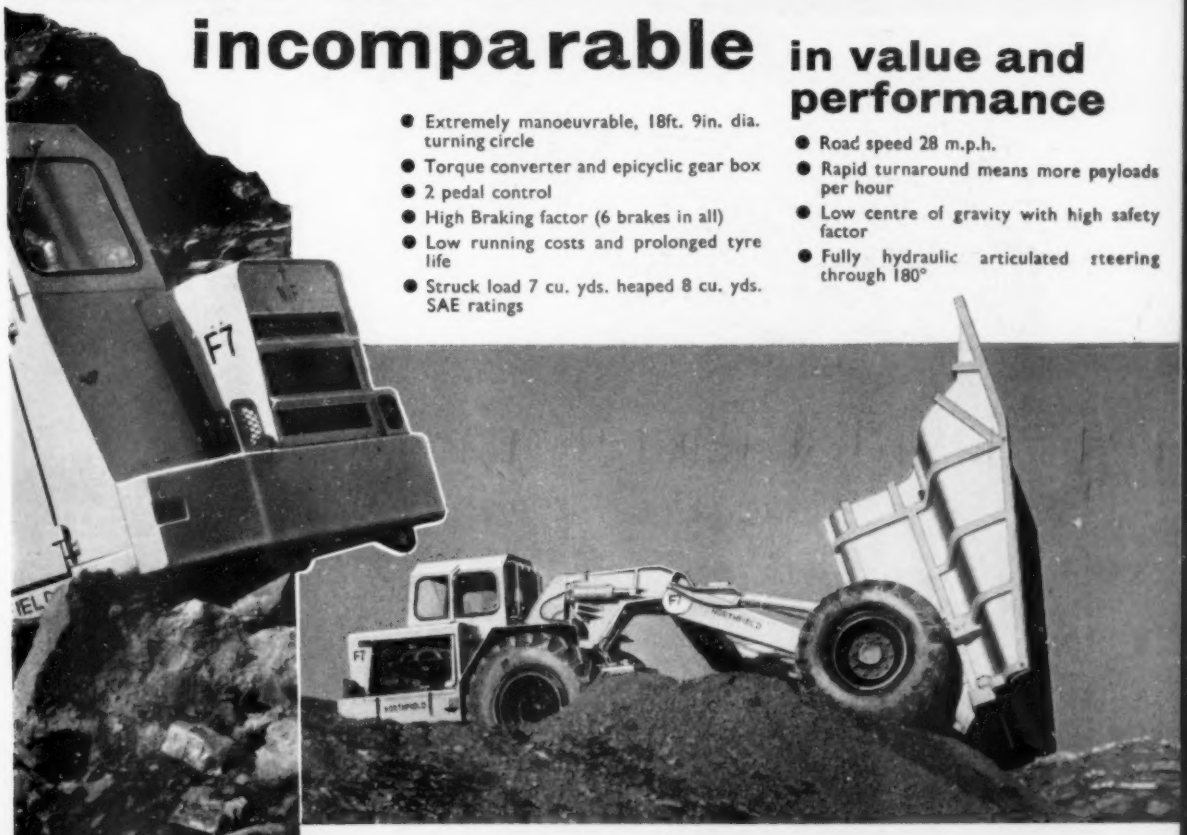

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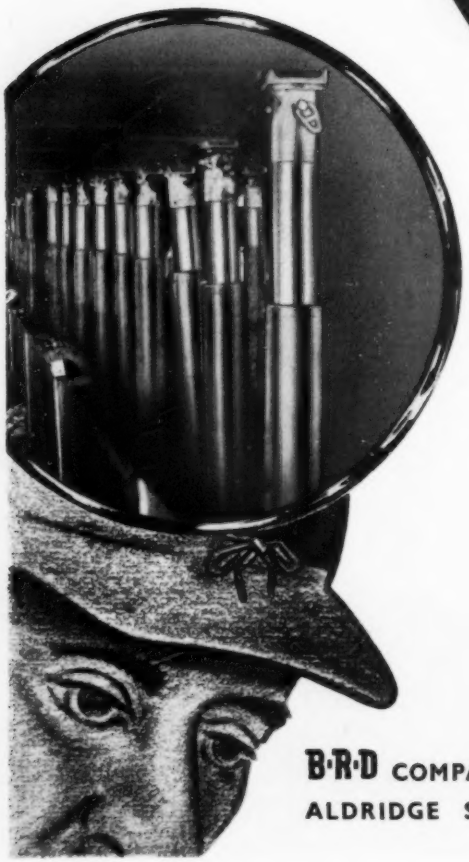

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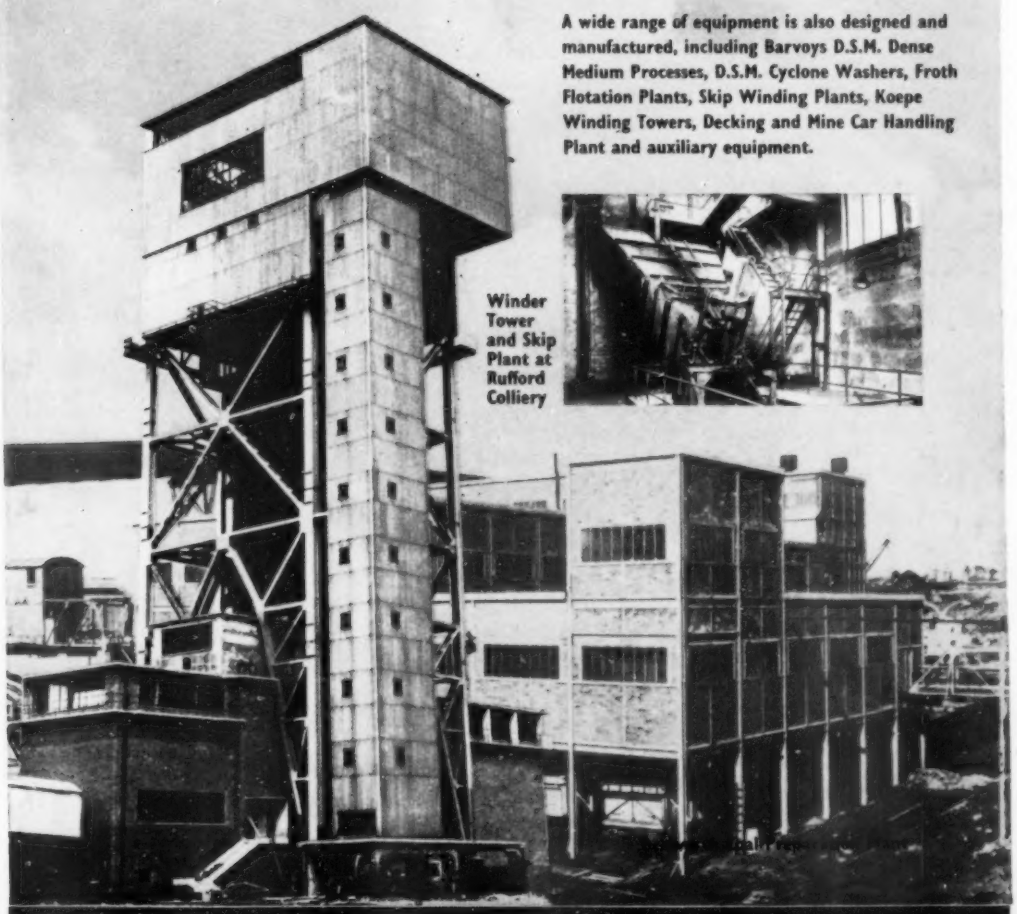
Winder Tower and Skip Plant at Rufford Colliery



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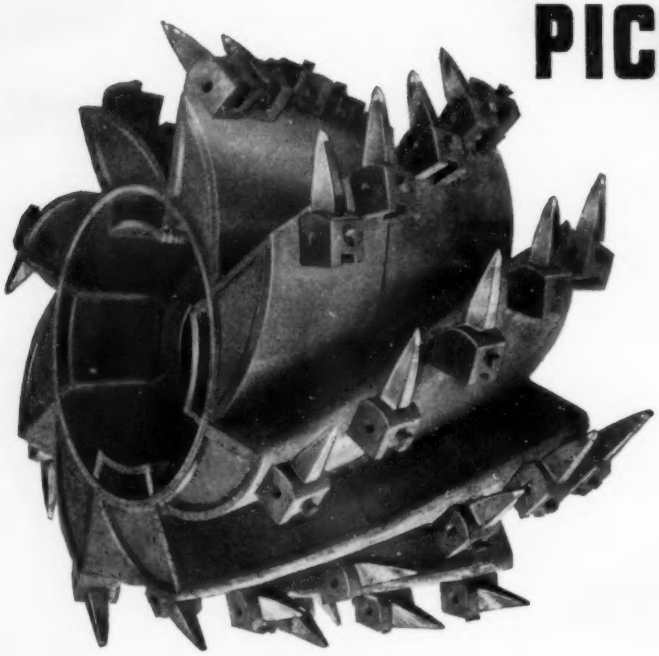

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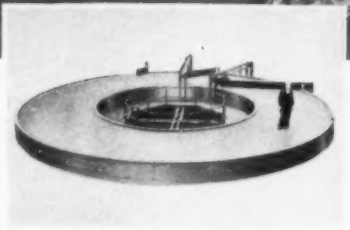
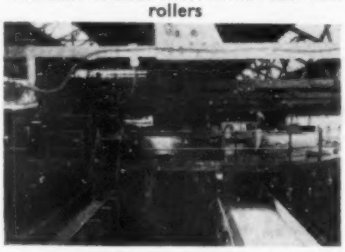
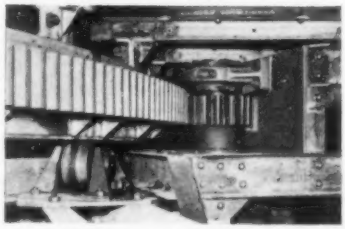


The table rotates on 24 turned cast iron rollers



Separate belts convey the graded coal



The driving gear is built up from 16 identical cast steel segments.

For the production of large coal, the Rotary Sorting Table has the following advantages over the old picking belts:-

(a) Reduction of degradation by eliminating cross belts and complicated transfer points.

(b) Considerable saving in manpower.

(c) Sorting is simplified by the use of rakes (see photograph above).

(d) Ease of supervision. The operators form a compact group on the inside and round the periphery of the table.

The improved drive (patent applied for) incorporated in the Rigley Table has reduced maintenance to an absolute minimum. One of our tables has been in continuous operation for over three years and handled over two million tons of coal without breakdown or major renewal.

Our Engineers will be pleased to advise on the size and type of table to meet your requirements.

WILLIAM RIGLEY & SONS LTD.,
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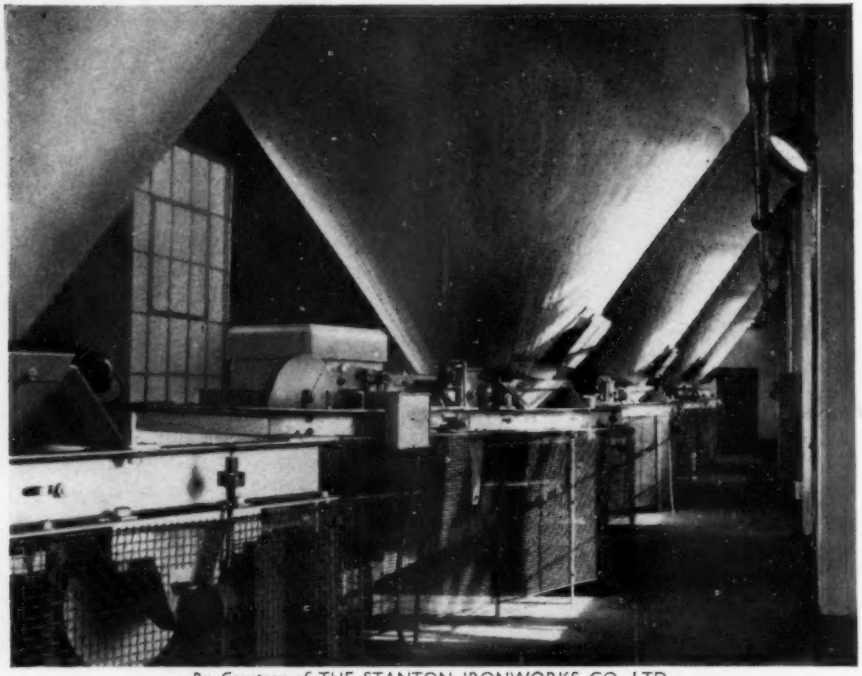
CONTINUOUS FEEDING BY WEIGHT



By Courtesy of THE STANTON IRONWORKS CO. LTD.

ILLUSTRATION SHOWS AN INSTALLATION OF FIVE

SIMON

PATENT CONSTANT WEIGHT FEEDERS

BLENDING COAL BY WEIGHT FOR FEEDING COKE OVENS

★ ROBUST AND ACCURATE • SIMPLE TO ADJUST

★ USERS STATE THE ACCURACY IS BETTER THAN ½%

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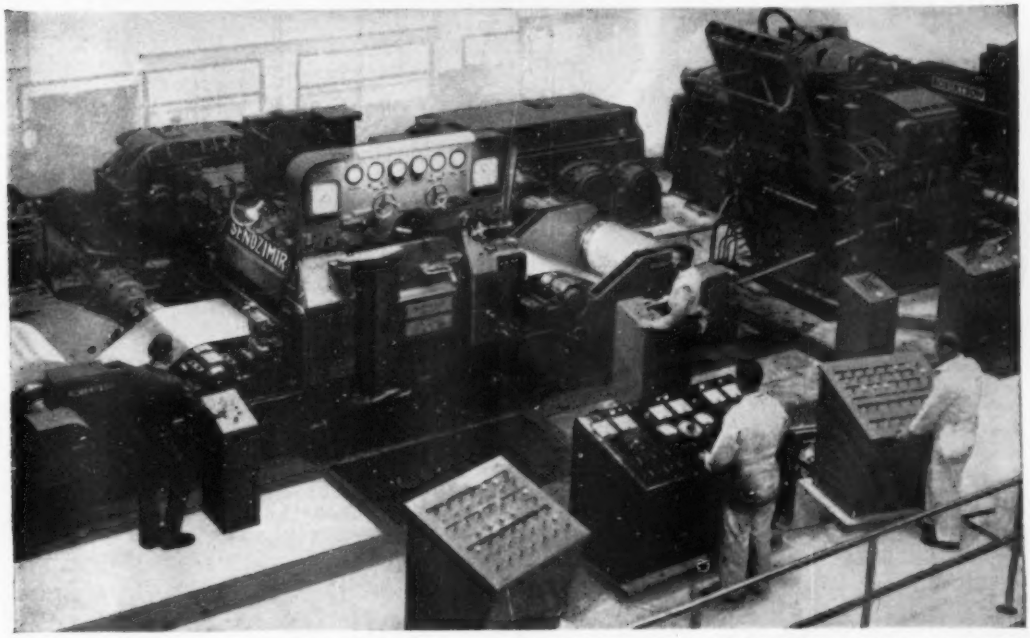

Photograph by courtesy of the Commonwealth Steel Co. Ltd., Unanderra, N.S.W.

Sendzimir ZR 22 – 42 in. Reversing
Cold Mill for rolling carbon
and stainless steel strip.

Installed by Robertsons at the works of the Commonwealth Steel Co. Ltd., New South Wales.

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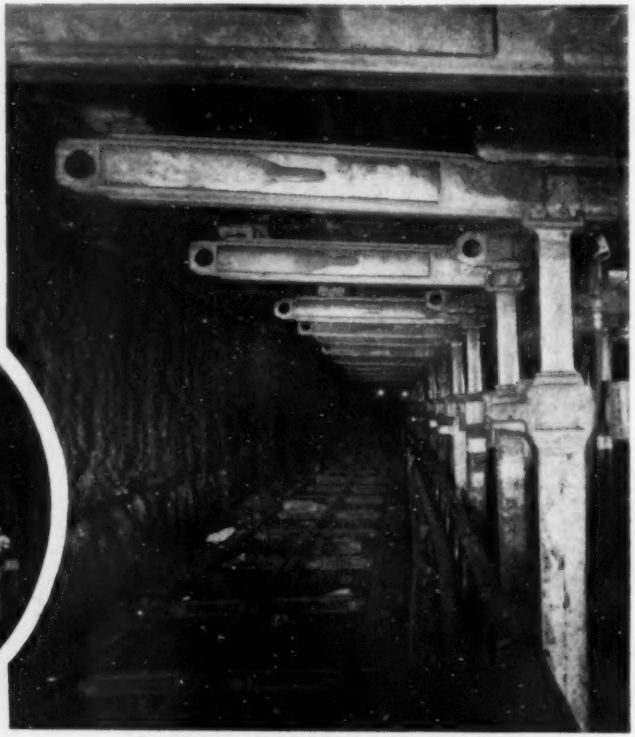
TORSION PROPS

Application of Hydraulic Clamping Device



GHH Torsion Props (NCB approval M 20) and GHH TZG 120 Bars (NCB) approval B3)

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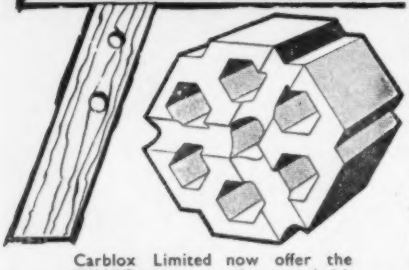
For your conveyors, whatever the load, there is a BTR belt that's right for the job!

1/3205

*Extra Blast Furnace capacity
*Greater resistance to Iron & Slag attack
*Low after-contraction
*High thermal conductivity
*No deformation under load of 2 tons per sq. inch
*2 or 3 times as resistant to abrasion & cold crushing strength 4 times that of ordinary fire brick
"... in fact



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are more efficient on every count"

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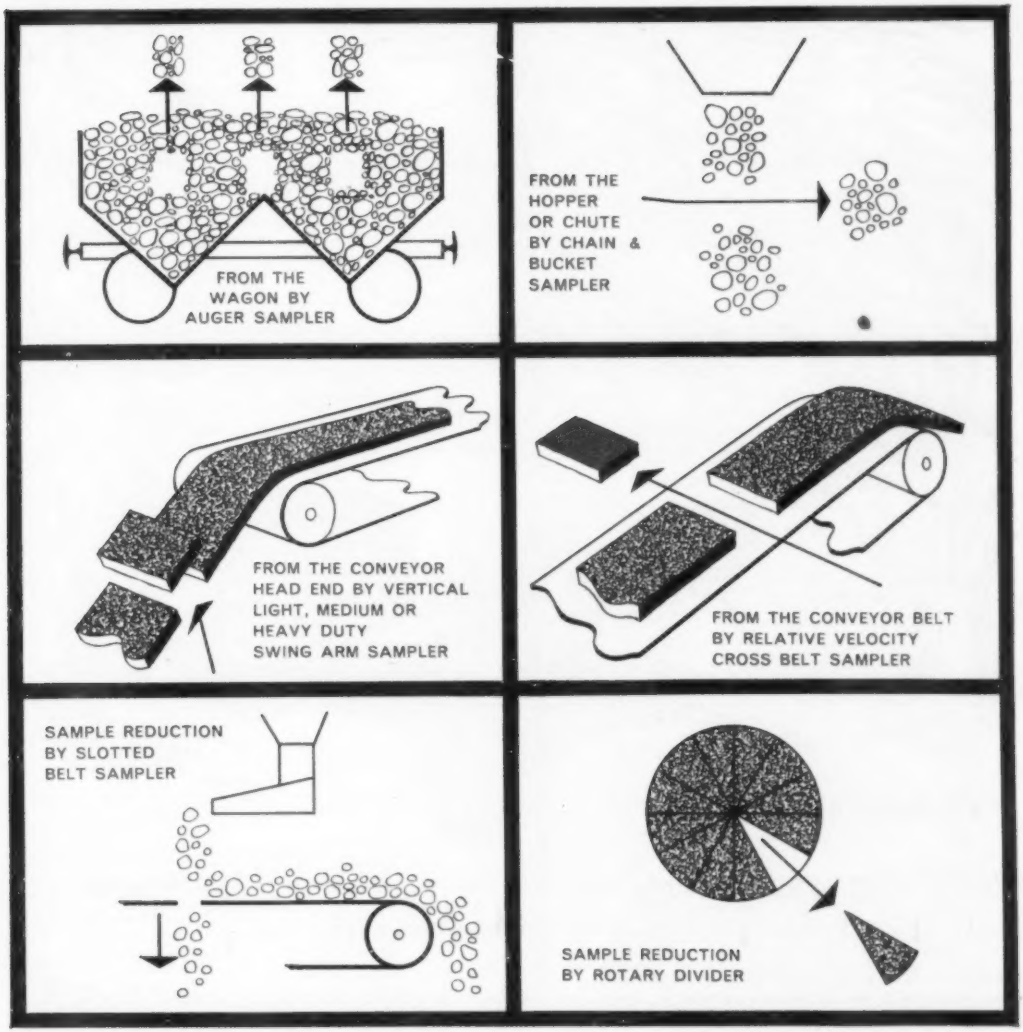
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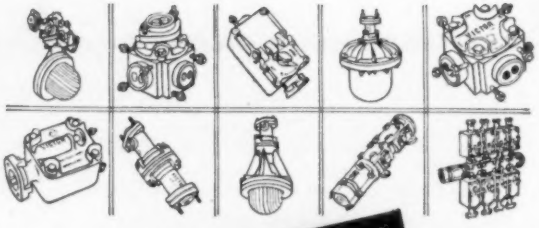
Thus lighting arrangements can be speedily extended or modified—or dismantled with equal facility.



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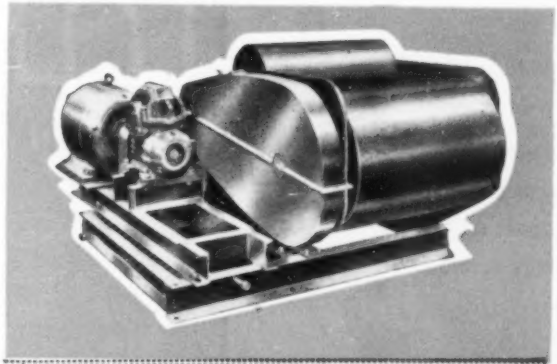
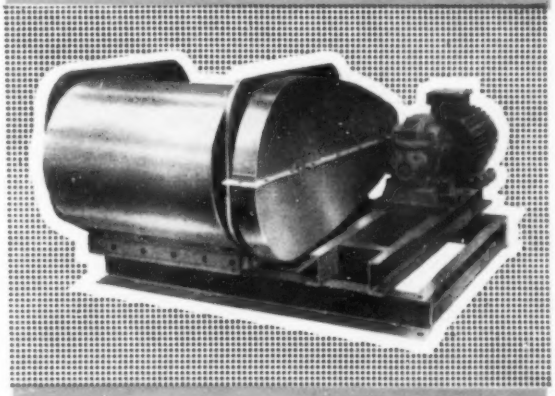
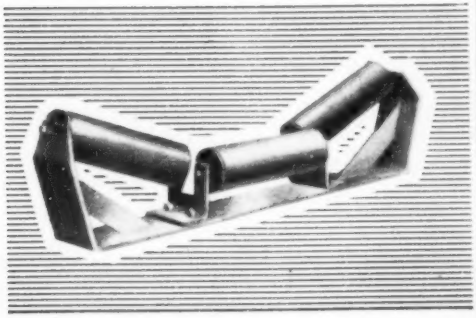
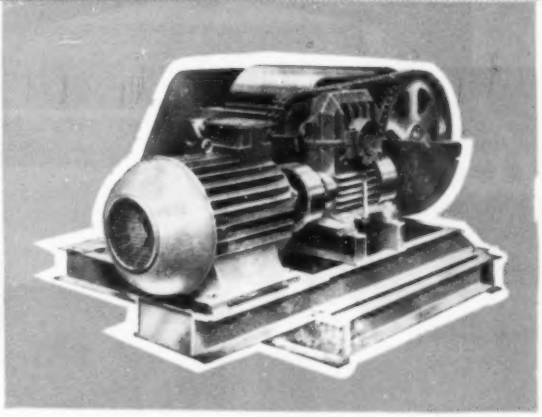
One or more of the heads shown on this page are sure to suit your special conditions. The idler set in its various sizes will suit everybody.









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Sutcliffe tubular framework has been designed to give resilience to the belt under all conditions of load. The automatic variation in depth of trough reduces dangers of belt damage and degradation. Easily and neatly packed, simple and speedy to erect—it retains the quality and strength characteristic of Sutcliffe equipment.

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- Assists in conveying against gradients.
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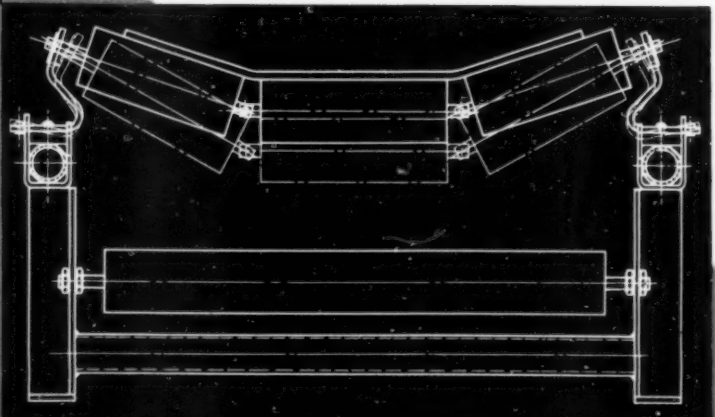
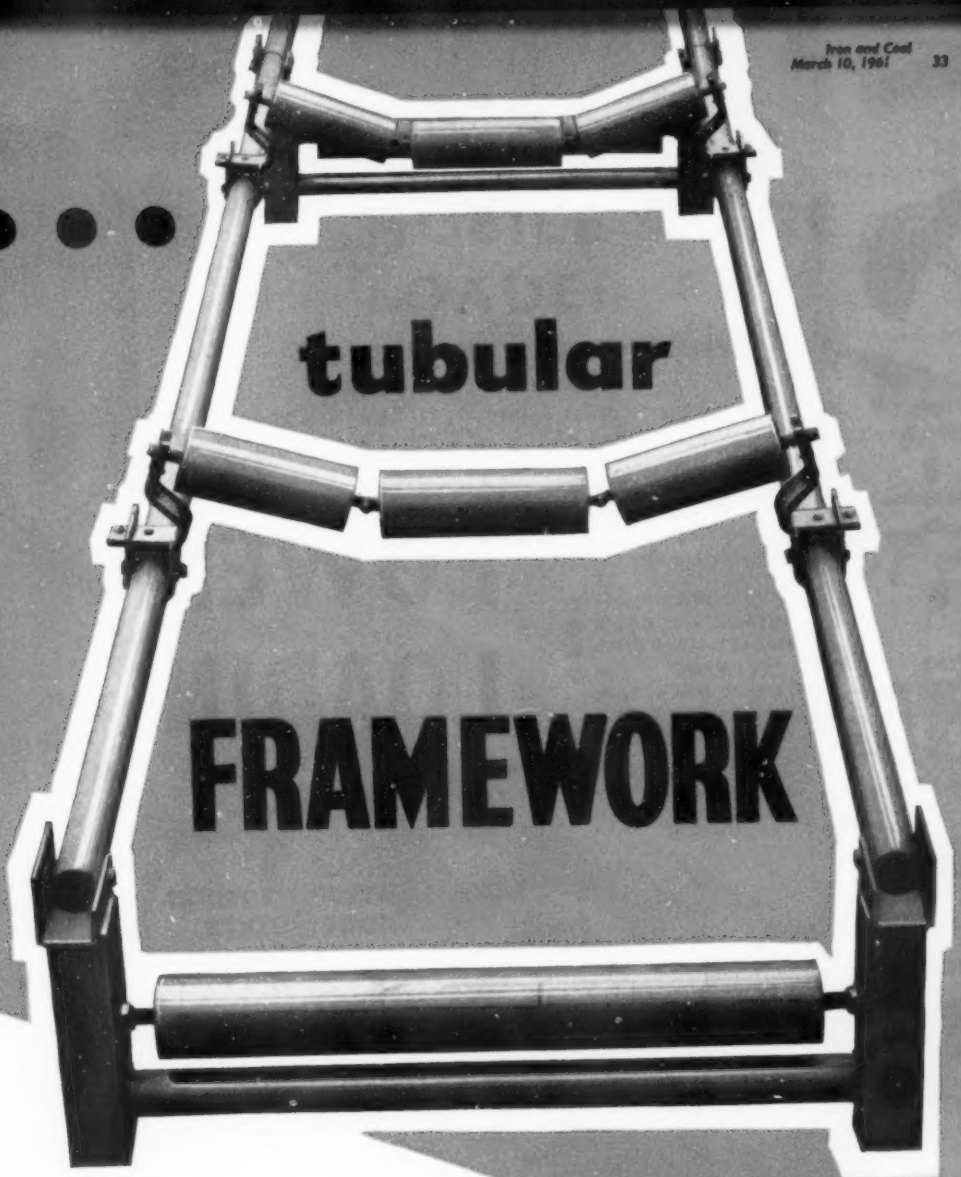


• • •

tubular



FRAMEWORK

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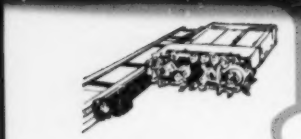

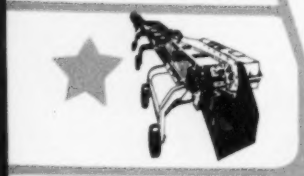

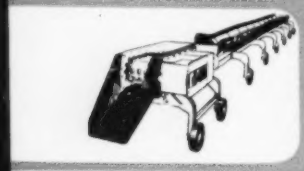

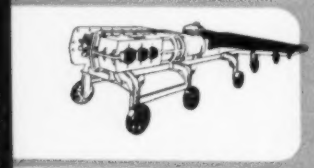

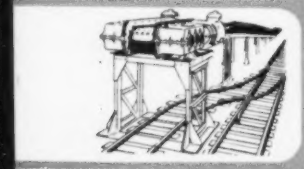

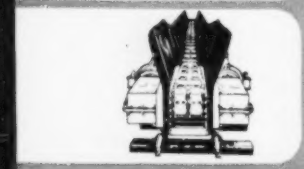

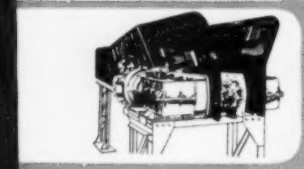

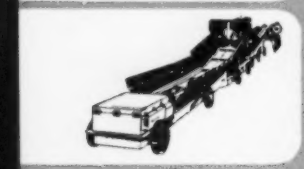

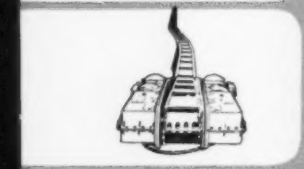

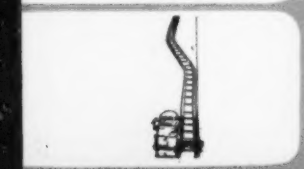

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The drive frame is machined as standard on both sides enabling either left or right hand fixing, with 20 or 50 h.p. gear box as required. Chain speed from 150 to 220 ft. per min. to suit individual conditions.

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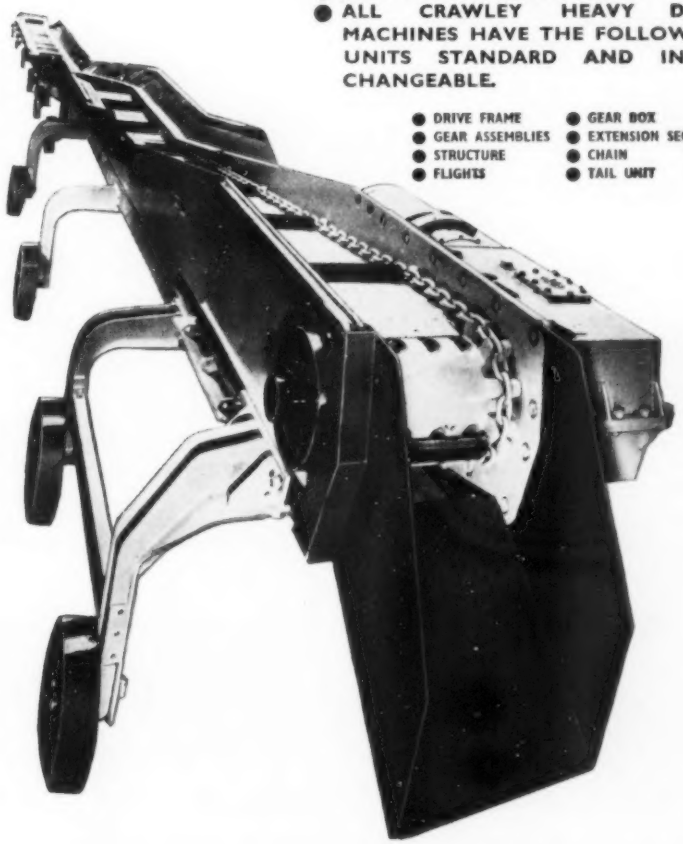

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SCALPING
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WASHED COAL SIZING
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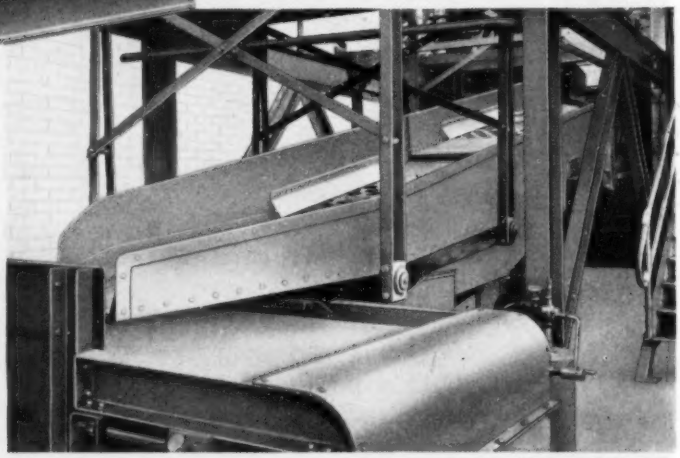
●
PICKING BELTS
●
VERTICAL PICK BREAKERS



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Also complete **COAL CLEANING AND HANDLING PLANTS** of the most efficient type including **COAL WASHERIES** of any capacity designed to clean **RUN-OF-MINE COAL** arranged with

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MIDDLINGS
RETREATMENT
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WATER
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The **NORTON-HARTY**
ENGINEERING COMPANY LTD.
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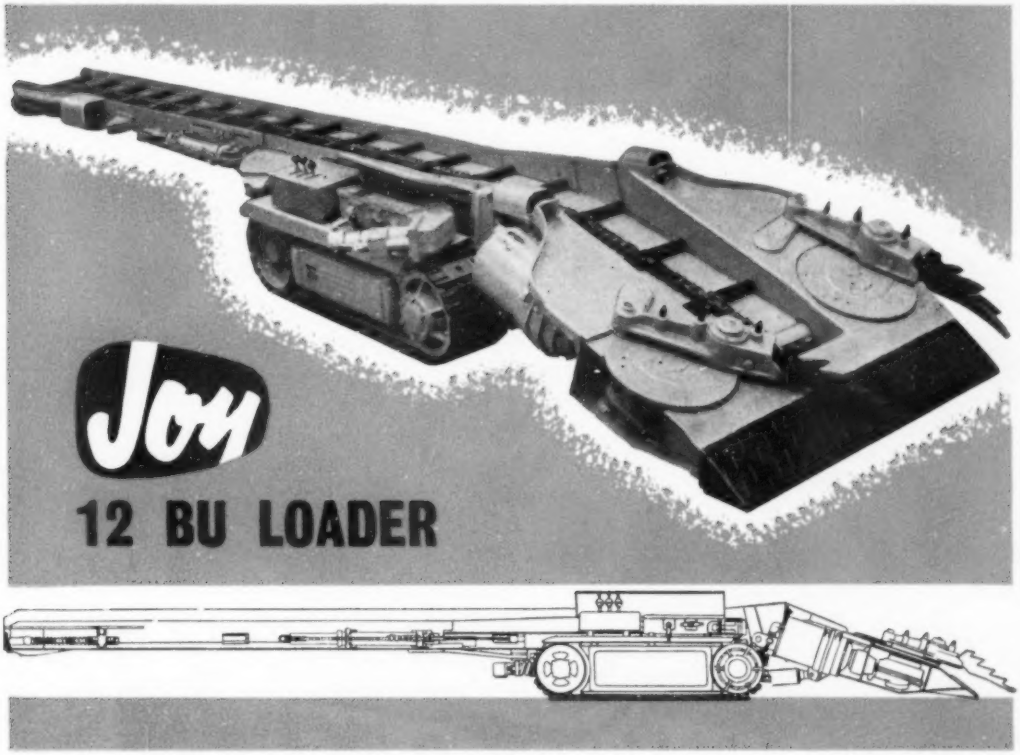

-standard practice for mechanised thin-seam mining.

In recent years the tendency in many British Mines has been to base loading systems on that well-proven JOY machine—the 12 BU Loader. Nor are the reasons hard to find. The 12 BU Loader works in seams down to 30-inches high: the rated capacity is one ton per minute: the width is only 56″, and with articulated rear conveyor and independently operated crawler tracks it is extra-ordinarily manoeuvarable.

20 years successful operation of this machine has provided ample proof of its performance and reliability under widely varied conditions.

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12BU

Simply a question of know-how

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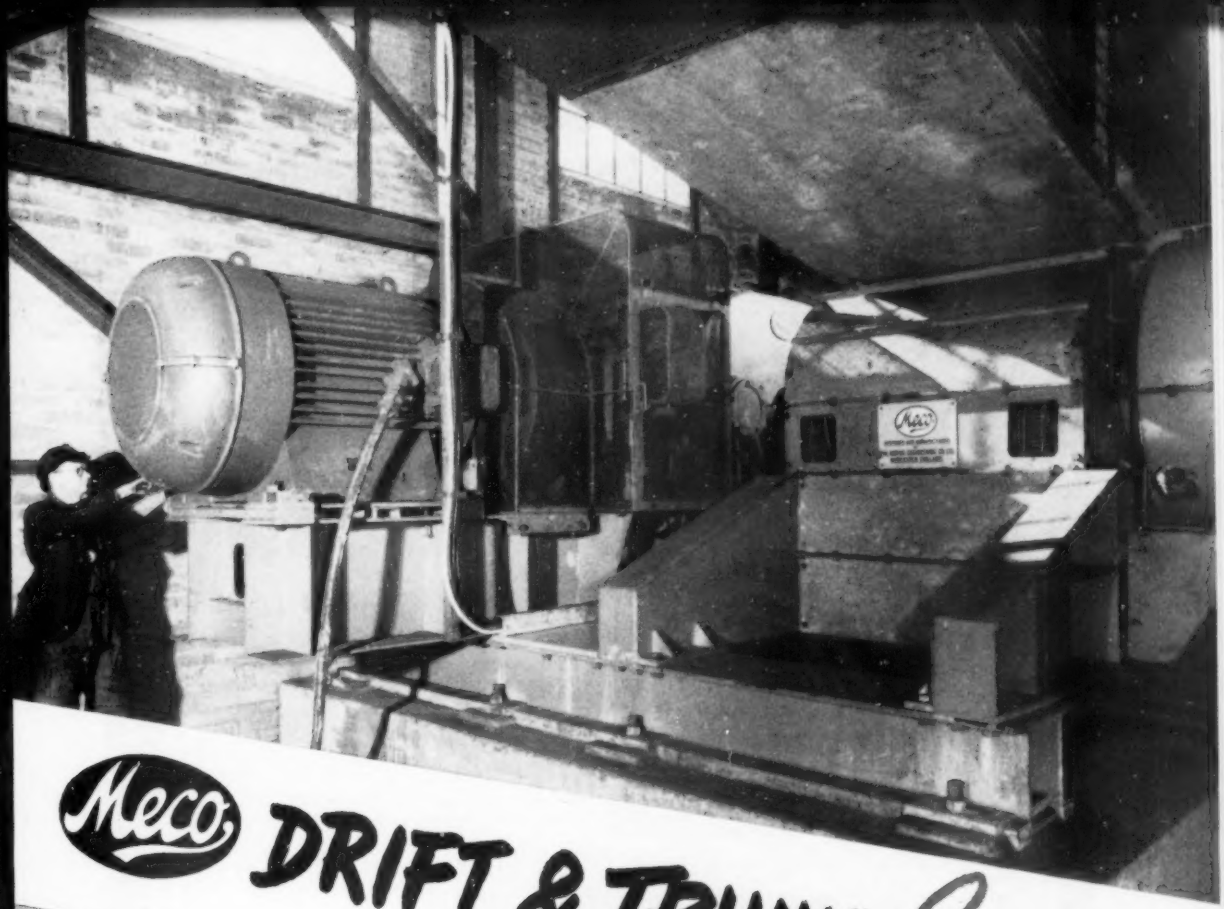

Meco DRIFT & TRUNK Conveyors

The top illustration shows a Meco power pack rated at 45,000 ft. lbs. used as a single drive for a double drum belt conveyor driving head. The conveyor is 2,146 ft. long with a lift of 478 ft. and carries 2,000 tons day run-of-mine coal. The H.P. rating is 300 at 400 ft./min.

MECO STANDARD POWER PACKS, SINGLY OR IN COMBINATION, CAN BE BUILT UP TO THE MAXIMUM POWER OF ANY AVAILABLE HIGH DUTY CONVEYOR BELTING.

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London Office: 50 Pall Mall, London, S.W.1.
Telephone: Trafalgar 4686/7.
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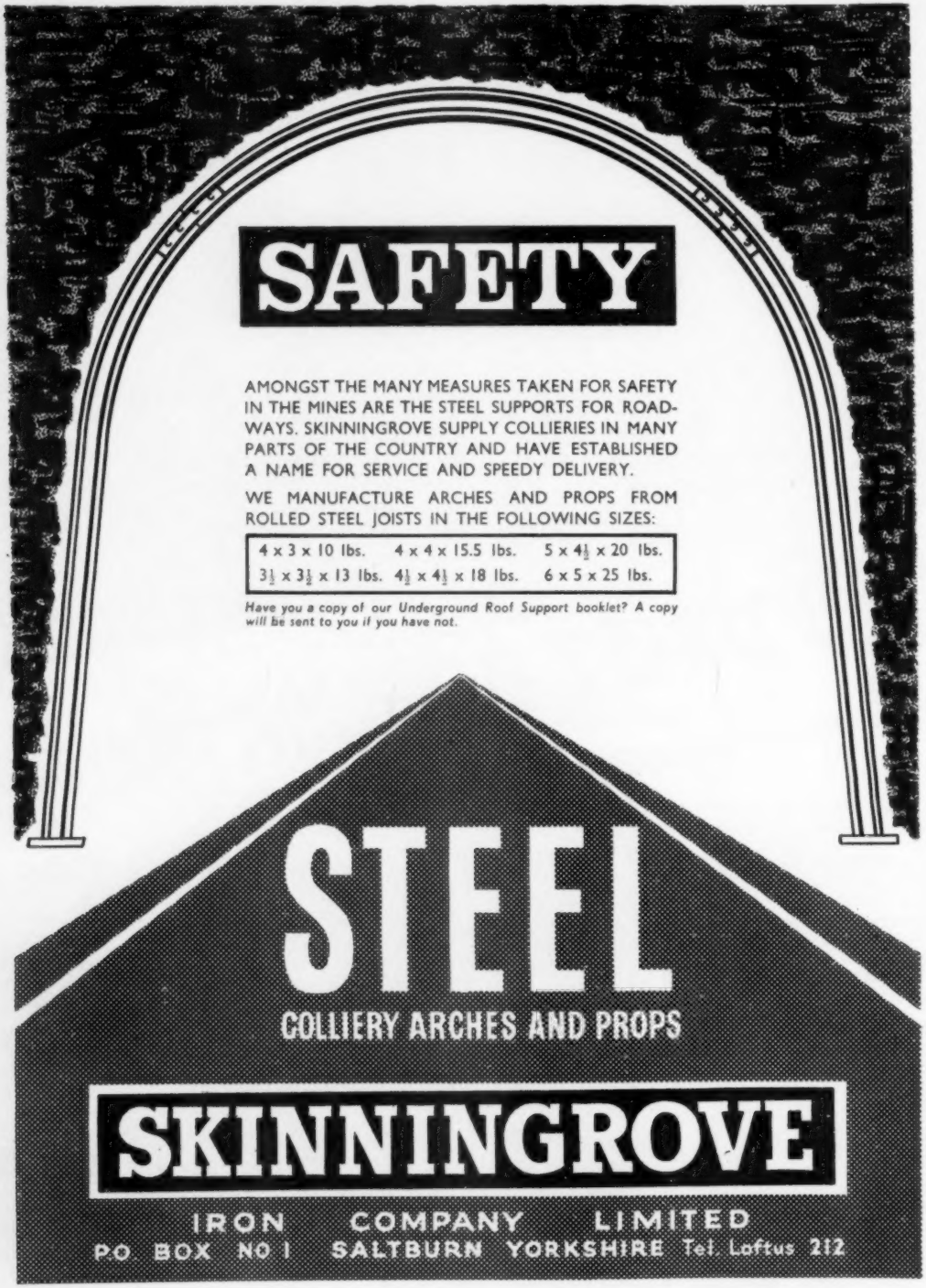
L.P. 213—11C



SAFETY

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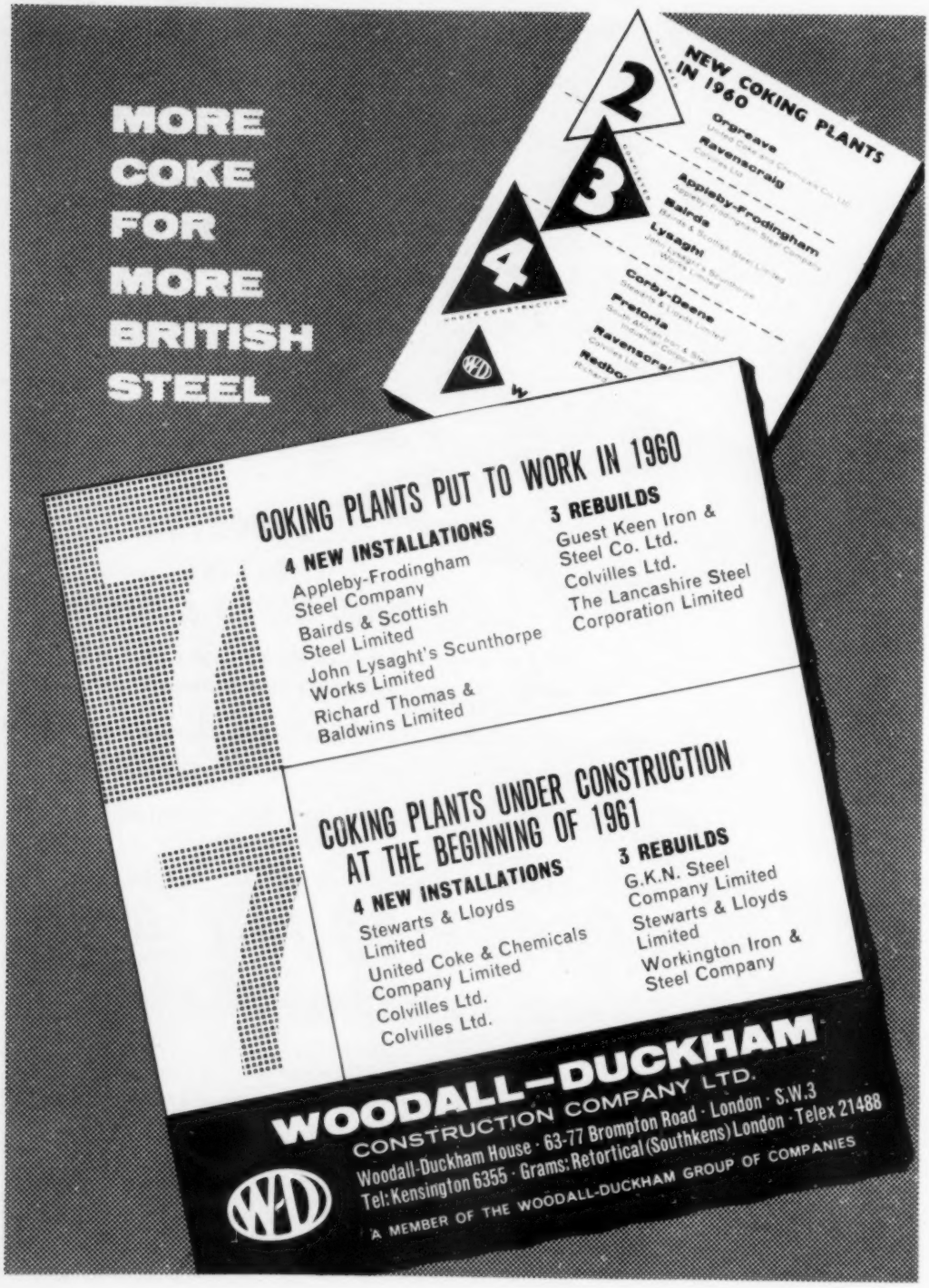
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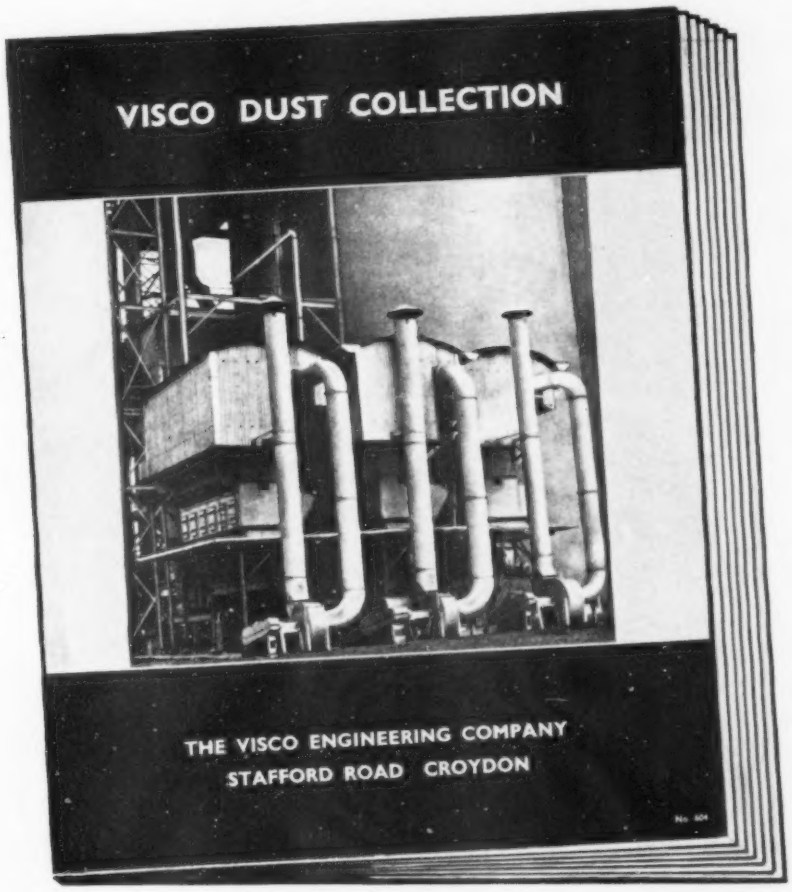

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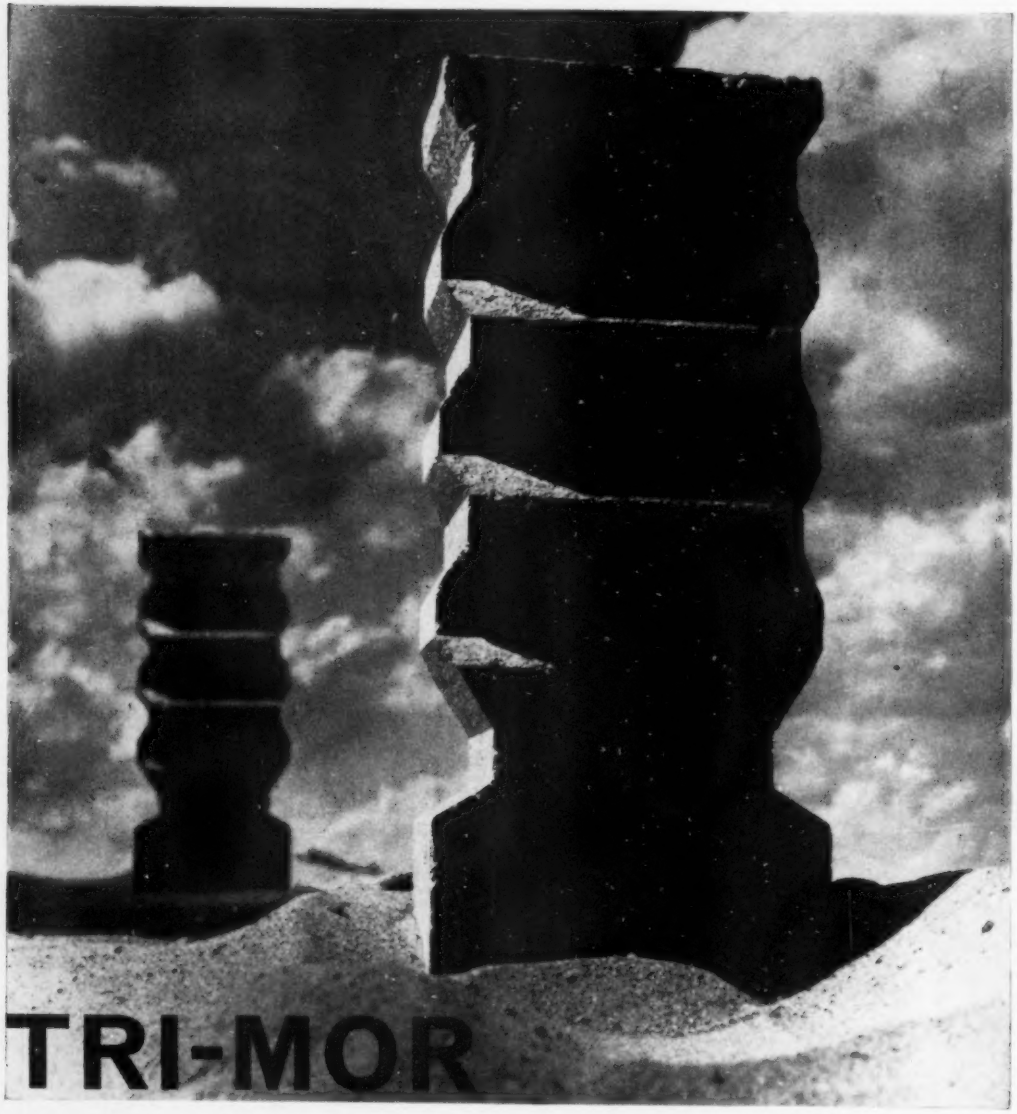

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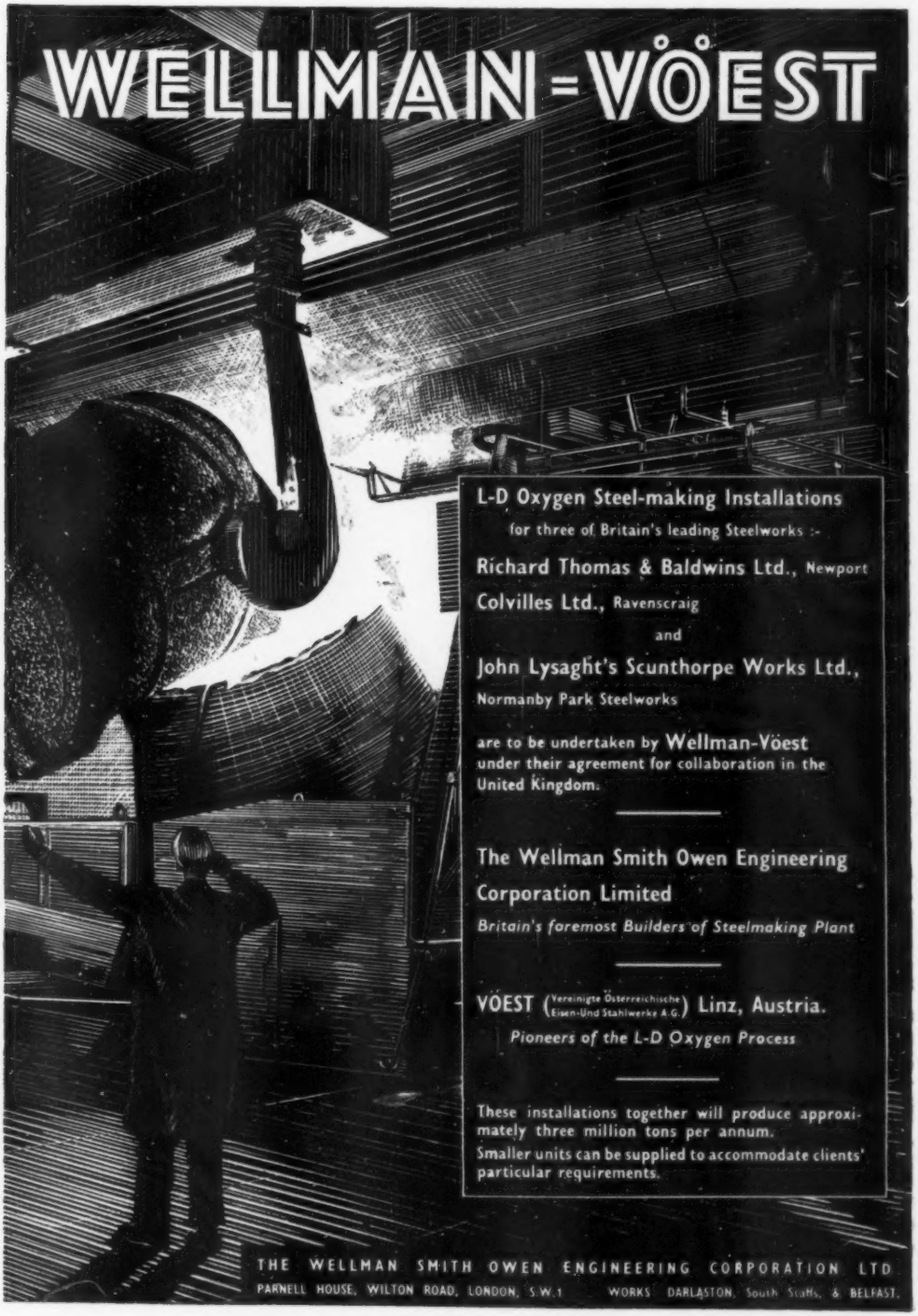
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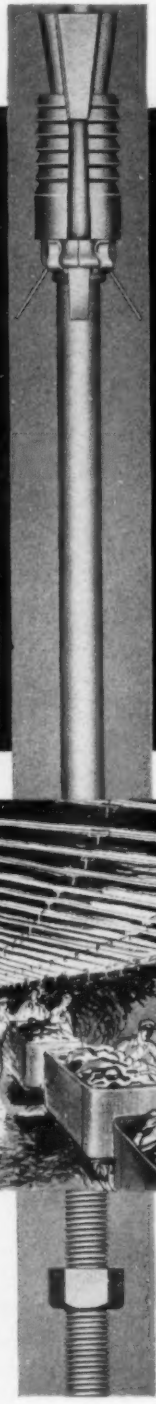

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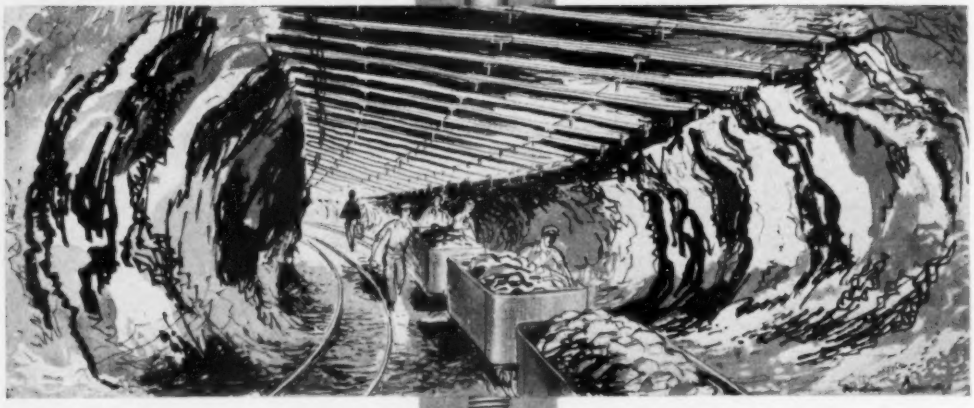

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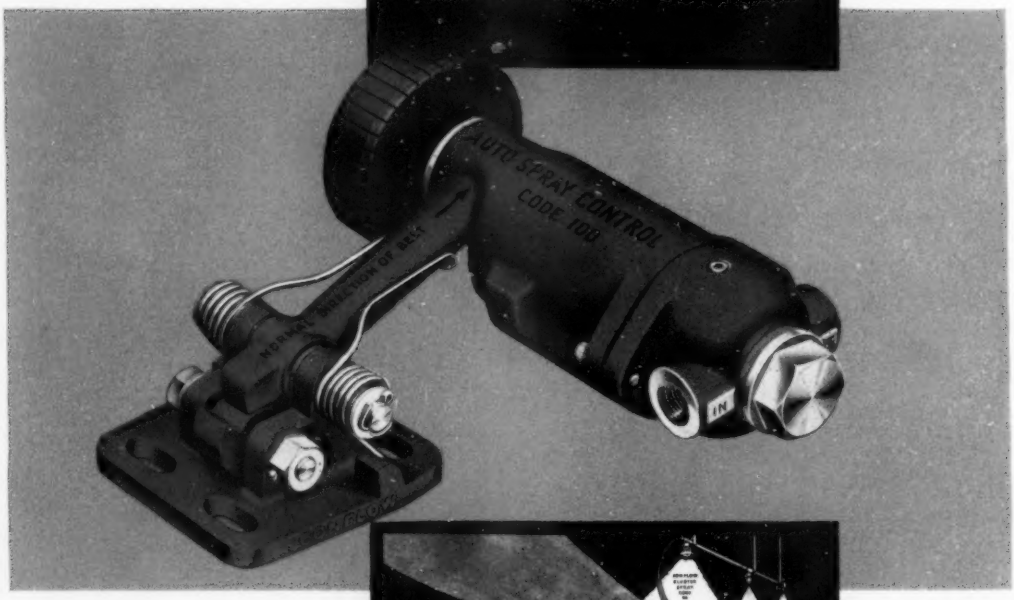

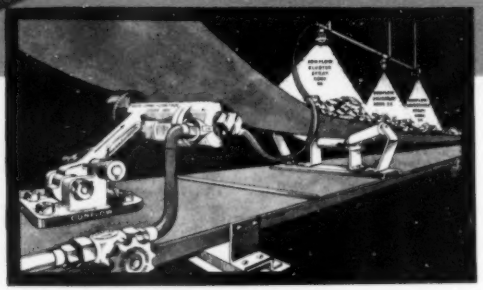

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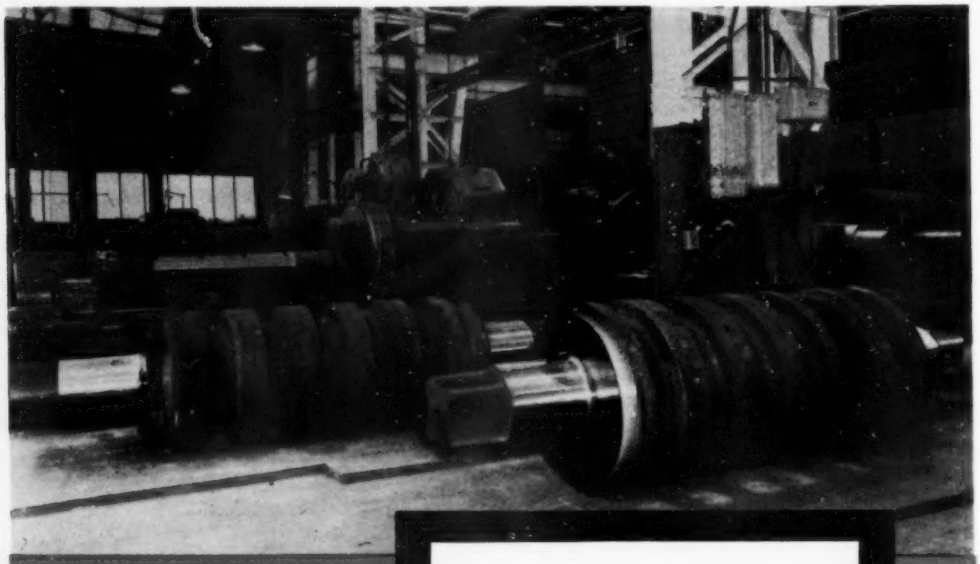

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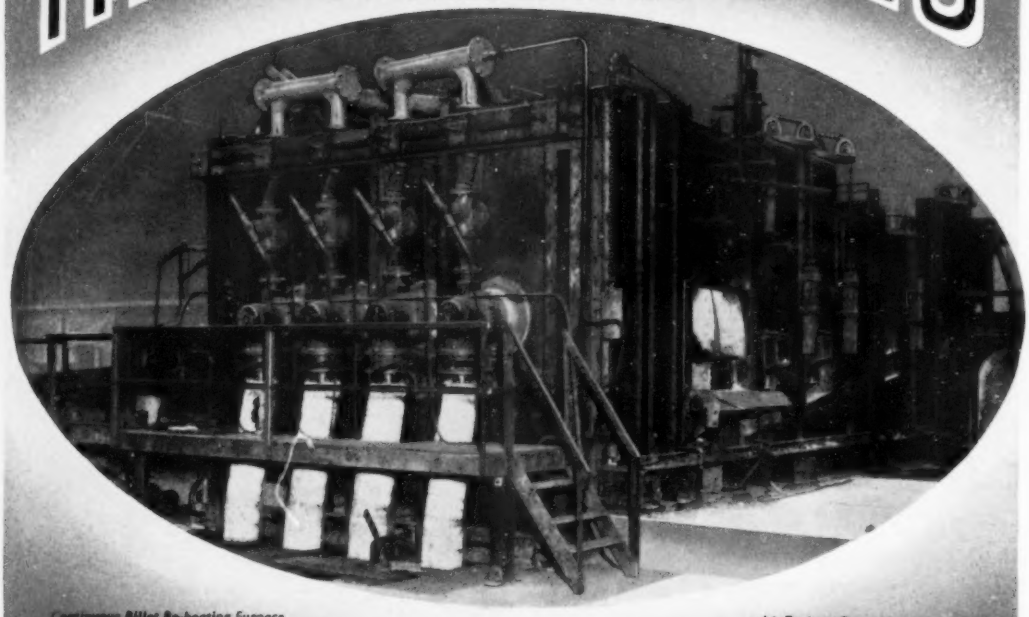

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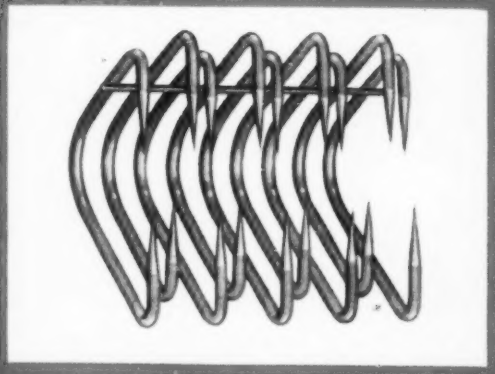

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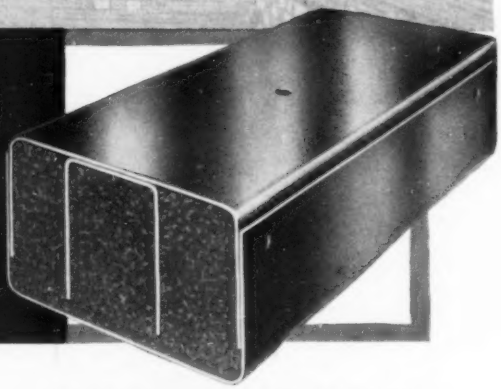

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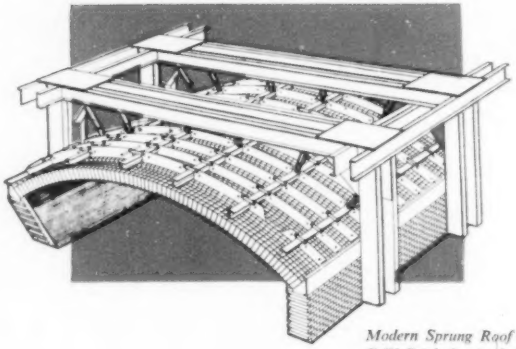

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Vol. 182
No. 4834

IRON & COAL
THE IRON AND COAL TRADES' REVIEW

MARCH 10
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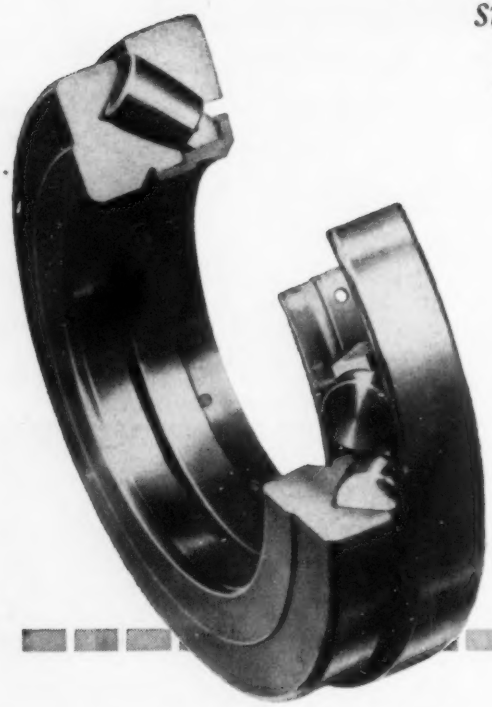

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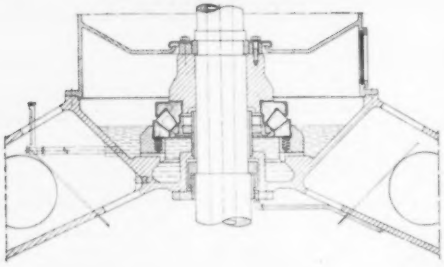
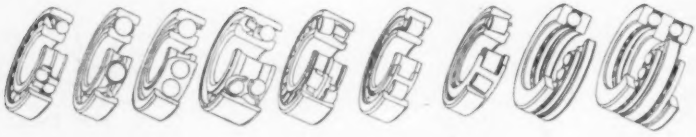


Support bearing for vertical electric generator



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Vol. 182 March 10, 1961 No. 4,834

The Rand Report

FOLLOWING an Order of Council of October, 1959, the Hon. I. C. Rand, QC, Dean of the Law School of the University of Western Canada, was appointed a commissioner to inquire into and make recommendations concerning: (*a*) the present and future markets for Canadian coal; (*b*) the steps that can reasonably be taken to reduce the cost of production and distribution; (*c*) the steps that the Canadian coal-producing industry can take to secure as large a market as possible for Canadian coal and to place and maintain the industry on an economic basis; (*d*) the measures that can reasonably be adopted by Governments to support economic production, distribution, and sales of Canadian coal, and (*e*) such other related matters as the commissioner considers appropriate.

This one-man Royal Commission commenced its task in December, 1959. Its report, completed nine months later, was published in November, 1960—much faster than is usual for a Royal Commission report—possibly because it was a one-man commission, but more probably because, with only one commissioner, there were no delays in arranging meetings to suit the convenience of a number of commissioners with other preoccupations. The commissioner had the assistance of a technical adviser, a special adviser, and a labour adviser, together with legal counsel; he had also the benefit of advice from, as well as informative reports and studies on a number of pertinent topics prepared by, officers of appropriate Government departments.

The special adviser was Mr. W. V. Sheppard, director-general of production and reconstruction of the National Coal Board. He conducted a critical examination of the operations of the various coal subsidiaries of Dominion Steel & Coal Corporation, Limited. His interesting report, which was clearly of great assistance to the commissioner, forms a valuable appendix to the Rand Report.

During the course of the 127 days of public hearings, the commission received 58 submissions from bodies covering almost every conceivable interested party. Special arrangements were also

Copies of the Index to Vol. 181 are obtainable (post free) on application to the Publisher.

communities of Canada, to observe the social and economic aspects of the problems facing the industry, to hold informal discussions with elected civic officials and leading citizens, as well as to make inspections at strip mines and at deep mines, both on the surface and underground.

The Royal Commission on Coal which reported in 1946 met under very different conditions. It was concerned with a situation in which, "as a fuel, coal was dominant and the competitive supplying of Canadian requirements was the primary issue," when hydro-electric generation supplied 8 per cent. of the heat energy and petroleum (virtually all foreign) 24 per cent., while coal contributed 60 per cent., leaving the small remainder for natural gas and wood. Today, the scene is vastly different. Discoveries in Alberta in 1949, together with the astonishing increases of production in the Middle East, South America, and, to some extent, in the United States and the USSR, have placed oil in a commanding position. Natural gas from Alberta in huge supply followed, and oil and gas from that Province now flow in pipelines from Edmonton to both Toronto and Montreal, with early prospects of further easterly extensions. Hydro-power has also greatly expanded and, although Ontario may be near the end of its water resources, formidable reserves in Quebec still await development.

Some measure of the change in the fuel position is given by the fact that, in 1946, the largest individual consumers in both eastern and western Canada were the railways. By 1948, they consumed nearly 12,500,000 tons of coal. Today, probably not a single locomotive in the two transcontinental systems uses coal. Fifteen years ago the domestic use of coal was extensive; now it is largely replaced by gas and oil. As a fuel for general industry, coal now remains only to a small degree competitive; but the retention of even that position can only be described as a bitter struggle. As in the Western world generally, energy in Canada is now at a flood excess. The problems of the Canadian coal industry, although relatively minor in a world setting, have, nevertheless, become of immediate concern because of geographical and social as well as industrial circumstances.

It is the view of the commissioner, that apart from such markets for coal as that for metallurgical coke, as a raw material for certain chemicals and for use at thermal power stations, the superior position of oil and natural gas is likely to be maintained for at least another 25 years. After that, coal may once again be called upon to meet a much bigger portion of the country's energy demand. For the present, however, the facts suggest that considerable contraction in coal production is inevitable—a reality that is squarely faced by Dean Rand in his report. The immediate issue has thus been transformed. The problem now is

made for the commission to visit the coal-mining not so much coal competition as interim continuity for much of the coal industry.

The 1946 report recommended a continuance of the Dominion Government assistance to coal production in the form of transportation subventions. The 1960 report proposes to replace these subventions by direct subsidies. Altogether, the report makes 16 recommendations. Eleven of these deal with ways of assisting the coal industry in the face of dwindling markets and fierce competition from oil and natural gas. The other five deal with such matters as the need for a change in the composition of the Dominion Coal board, for new industries in Cape Breton, for the establishment of a trade and vocational school near Sydney, the need for more basic coal research, and for greater efficiency in the coal-mining operations of Nova Scotia.

In addition to establishing maximum subsidies, the report recommends subsidies of two kinds—a basic subsidy to help mine operators to maintain at least skeletal operations and conserve in some degree present mining investment values, and a social subsidy for the coal regions of the Maritime Provinces, aimed to protect mining communities theatened with abrupt collapse. The expectation is that the proposed schemes of subsidies will not only induce disposal of coal in the nearest or natural market, but will also give threatened communities a breathing space to examine their position and in general "to prepare to accept consequences nearer to ordinary competitive industry." Withdrawal of the transport subventions will undoubtedly mean a loss of markets where long hauls are involved. The commissioner thought it was "an ultimate in abusurdity" of the present system whereby coal was sent at the Government's expense for 1,000 miles to compete with a foreign fuel.

In short, the industry is to some extent to be "moth-balled" to preserve it for a future when it is expected that Canadian coal will once again be in much greater demand than it now is. The implications of the proposals and recommendations in this most interesting and complex report will no doubt receive the serious and meticulous study of the Canadian Government. It deserves much wider consideration. All who are interested in the framing of a national policy for coal, or, indeed, in the wellbeing of coal mining in this and other countries will profit by a study of the Rand Report.

ECSC INCOME AND SPENDING

REVENUE received by the High Authority of the European Coal and Steel Community from subscriptions in the second half of 1960 (the first half of its 1960/61 financial year) totalled US $16,200,000.

The Authority spent $12,100,000, compared with $16,000,000 in the previous six-month period.

Passing Thoughts . . .

RESTRICTIVE trade practices normally fulfil no useful economic purpose. But mergers very often do. The trend of economic and technological development is increasingly enhancing the advantages of large organizations as opposed to small, and mergers are an obvious way of utilizing these advantages—The Director, journal of the Institute of Directors.

We spend on matches a third of the total we spend on research.—DR. J. A. POPE, *formerly Professor of Engineering at Nottingham University, speaking at Sheffield University Engineering Society.*

A high proportion of accidents are caused by objects falling on and damaging the feet, which results in many lost manhours and substantial cost to the country. Why, therefore, does the Government insist upon levying a 5 per cent. purchase tax on safety shoes which are specially designed to strict British Standards Institution standards to obviate such accidents?—Letter in the Financial Times.

National self-depreciation no doubt had its value to the British people in the days of the Empire, but faced with the necessity to export it is suicidal. —MR. E. J. HUNTER, *chairman of Swan, Hunter, & Wigham Richardson, Limited, Wallsend shipbuilders.*

We have learned that the worker's desire to create, to reap the benefits of his toil, and to think well of himself are more powerful than his propensity to swing the lead. We know that if a man does not do a fair day's work it is generally not due to anything inherent in his nature but to some other influence.—MR. W. COUTTS DONALD, chairman of the Management Consultants' Association.

Some miners are being led by the nose through not using their heads.—Editor of the Yorkshire Post in a note to a miner's letter on the strike.

It hurts me to see our union being disgraced and reduced in status in the eyes of the rest of the country. There is a lot yet to be done but now a point has been reached where the Coal Board should be getting a good return for the magnificent way it has gone about reforming the pits, including bringing the wages of the miners almost to the top.—MR. JOE HALL, 73-year-old past president of the Yorkshire Area of the National Union of Mineworkers.

I am often asked if a handful of men can shut a pit down if the majority of the men, as may well be the case, would be willing to go on working. My answer, after nearly 52 years among them, is that they can and do.—MR. SAMUEL CHEESBROUGH *in a letter to the Yorkshire Post.*

Many people who burn bituminous coal in old-fashioned grates with badly-placed flues refuse to see themselves as visual desecrators and part-time murderers. We, collectively, as a community, kill a large number of people in Sheffield every year through unnecessary air pollution from domestic flues—and for the most part we are complacent about it—PROF. J. K. PAGE, Professor of Building Science, Sheffield University.

FORMATION of an association of export management firms is to be considered at a meeting at the London Chamber of Commerce on Wednesday. Those wishing to attend should contact Mr. D. W. Mortlock, 115, Moorgate, London, E.C.2.

IRON CASTINGS OUTPUT

Record Figures by Industry in 1960

STEADY progress or sustained output in nearly all the major sections of the iron castings industry marked 1960, says the Joint Iron Council in its review of the Iron and Steel Board's production figures for iron castings during the year. These show that output in the fourth quarter of 1960 reached 1,024,690 tons, compared with 989,160 tons in the same period in 1959, and that the total output for the year reached the record level of 3,967,570 tons—nearly 13½ per cent. higher than in 1959 (3,498,030 tons).

With the final quarter of 1959 marking the full recovery of the industry from recession, 1960 started well, says the council. The automobile section went ahead again, exceeding the previous year's output by 12½ per cent., although towards the end of the year the difficulties in the motor vehicle industry made themselves felt. These were cushioned to some extent, as far as the foundries were concerned, by the relative buoyancy of demand for tractors and commercial vehicles.

The engineering section, in sympathy with some of the capital goods industries it serves, experienced steady progress as general capital expenditure on plant and machinery rose.

Rise in Construction Sector

A small rise shown for the building and domestic sections comprised a significantly greater increase in output for the purely building and construction castings, combined with a slight reduction in the output of castings for domestic durable goods, the latter being affected by the hire purchase restrictions early in the year.

Pressure pipes and fittings production was firmly maintained, although there was some reduction in the final quarter, while output of ingot moulds rose steeply to meet the needs of the steel industry. The railway equipment section, which had been experiencing rather weak trading conditions up to the middle of the year, achieved a marked increase in output in the second half. The advance in the industry generally was also shown by the number employed which, at the end of December, was 131,400—100 more than three months previous, and 3,900 more than at the end of December, 1959.

District production figures given by the Iron and Steel Board for the fourth quarter of 1960 (with the corresponding 1959 figures in parentheses) were:—

Eastern, south-eastern (including London), southern and south-western, 112,650 (114,250) tons; Midland, 222,200 (226,130) tons; north Midland, 204,380 (213,550) tons; East and West Ridings, 96,550 (92,330) tons; north-western 99,950 (91,530) tons; Northern 118,760 (100,140) tons; Scotland and Northern Ireland, 103,630 (88,870) tons; Wales, 66,570 (62,360) tons.

M. MOLE & SON, LIMITED, manufacturers of stampings, pressings, and diecastings, of Birmingham—Mr. C. Ernest Cowney, chairman, states that increased costs following the shorter working week had to be absorbed in order to meet keen competition. Net profit for 1960 was £44,332 (£43,886), after tax of £33,206 (£29,414).

Small Rise in February Steel Output

PRODUCTION of steel during February was at an average rate of 485,300 tons a week, 1 per cent. higher than in February, 1960. The production of pig-iron, at 302,400 tons a week, was only slightly higher than in the same month last year. Output in February remained below the high rates achieved during the autumn of 1960. It was limited at some works by a weakening in the demand for steel sheet and also by a seasonal fall in requirements of tinplate. Nevertheless, the February production was consistent with an output of between 24,000,000 and 25,000,000 tons, the expected result for the year.

The annual review of capital expenditure in the iron and steel industry shows that expenditure during 1960 amounted to £146,000,000, nearly 50 per cent. greater than in 1959. A further substantial increase in expenditure is expected in 1961.

Latest pig-iron and steel output figures (in tons), with the corresponding 1959 and 1960 returns, are shown in the following table:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1960—December ..	306,000	15,912,000	451,100	29,459,000
1961—January ..	308,500	16,040,000	478,400	24,876,000
February ..	302,400	15,727,000	485,300	25,236,000
1959—December ..	280,400	14,583,000	432,900	22,513,000
1960—January ..	297,500	15,470,000	471,400	24,511,000
February ..	301,500	15,680,000	482,200	25,073,000

New Scots Foundry Company

NEW foundry which Allied Ironfounders, Limited, is building at Larbert (Stirlingshire), is to be operated by a new company, Larbert Foundry, Limited. The new plant will cost £500,000 and will begin production in the autumn. Mr. R. L. Hunter, managing director of the northern group, said that the new foundry would offer improved working conditions and more jobs.

The group is to close two member companies of the northern group—Callendar Abbots & Dobbie Forbes, Limited, and the Forth & Clyde & Sunnyside Iron Companies, Limited. Mr. John R. Walker and Mr. A. D. Brown, the respective managing directors, are to become joint managing directors of Larbert Foundry.

In Parliament

Joint Committee to Boost Coal Exports

ESTABLISHMENT of a joint committee to integrate a British coal export drive with the general export drive was urged by MR. JAMES BOYDEN (Lab.), who suggested the body should consist of representatives of the National Coal Board, British coal exporters, and industrialists exporting to Europe steam power plant, electricity generating equipment, and other heavy plant using coal. MR. RICHARD WOOD, Minister of Power, said he saw no need for his department to sponsor a formal committee. If the interests mentioned thought such an arrangement useful, they would come together themselves.

MR. BOYDEN persisted that in the past British coal exports were extremely important, but under the present Government they had fallen to very small proportions. The Minister had some responsibility in the matter of bringing these interests together, he suggested. MR. WOOD replied that if any of the bodies mentioned thought such an association would be beneficial, he would explore the matter, and, if necessary, try to urge them to get together.

FACTORY ACCIDENTS RISE

FIGURES produced by the British Productivity Council showed an estimated loss from industrial accidents in 1960 of 19,000,000 man-days, and £100,000,000 in production, MR. JOHN HARE, Minister of Labour, said in reply to a question by MR. GERALD NABARRO (Con.). MR. NABARRO had pointed out that in 1959 there were 5,400 more factory accidents than in the previous year, an increase of 11 per cent., and in the first nine months of 1960 there were 14,000 more accidents, and an increase of 72 (14 per cent.), in fatal accidents, compared with the same period in the previous year. He asked the Minister what steps were being taken to reverse this trend.

MR. HARE replied that provisional figures showed that in all premises covered by the Factory Acts there were 190,000 reported accidents in 1960, of which 665 were fatal. Final conclusions about these figures had to await the report of the Chief Inspector of Factories for 1960, which would contain a detailed analysis of accidents and comparisons with previous years. Meanwhile, every effort was being made to make workpeople more safety-conscious.

LOANS TO RTB AND COLVILLES

GOVERNMENT statement on Wednesday disclosed that £27,100,000 of the steel loans to Colvilles, Limited, and Richard Thomas & Baldwins, Limited, will be taken up in the current financial year. MR. ANTHONY BARBER, Economic Secretary to the Treasury, said that the amount for Colvilles would be £15,000,000 and for RTB £12,100,000.

Regarding the further denationalization of steel assets, MR. BARBER repeated that it was the Government's aim to complete the denationalization of the industry within the lifetime of the present Parliament.

STEEL SECURITIES ADVERTISEMENTS

ASKED by MR. FREDERICK LEE (Lab.), in which publications the offer for sale of the prior charge securities held by the Iron and Steel Holding and Realisation Agency were advertised, the cost in each case, and from which the greatest return had come, MR. ANTHONY BARBER, Economic Secretary to the Treasury, said in a written reply: "The newspapers in which the details of the offer were published in full and the cost in each case were:—The Times, £8,250; Financial Times, £9,250; the Guardian, £4,950; Daily Telegraph, £12,210; Scotsman, £3,960; and Glasgow Herald, £4,440.

In addition, said Mr. Barber, abridged particulars were published in 25 other newspapers at a total cost of £9,859 10s. 6d. The information asked for in the last part of the question was not available.

NORTHUMBERLAND PIT UNEMPLOYMENT

ASKED by MR. JOHN MCKAY (Lab.), about unemployment in pits in Northumberland, MR. JOHN C. GEORGE, Parliamentary Secretary to the Ministry of Power, said that in February 316 men and boys whose last employment was in coalmining were unemployed there. Recruitment was not being impeded by either transport difficulties or shortage of housing, he added.

MR. GEORGE said the number of unemployed was less than 1 per cent., and the Coal Board was encouraging unemployed miners in that area to transfer to Yorkshire and the Midlands coalfields. They would receive appropriate allowances and, normally, would be moved only if housing was available.

WHITE PAPER to be published showing Government expenditure "below the line" will contain information about the level of internal resources available to finance the capital programmes of the coal mining and electricity supply industries in 1960-61 and 1961-62, compared with previous years, the Minister of Power told MR. GERALD NABARRO (Con.) in a written reply.

Coalfield Music Hath Charms . . .

AMONG the hot air which has been rising in the Yorkshire coalfield recently there was at least some of a melodious nature—that at the 12th annual Brass Band Festival of the North Eastern Divisional Coal Board, held at Sheffield on Sunday. Awarding the prizes to the winners in the second section of the three-section contest, Mr. W. H. Sales, divisional chairman, was quick to draw an analogy. "In the concert tonight there will be complete harmony," he told the 1,000 bandsmen taking part. "With all those differences between one instrument and another they can weld and amalgamate those differences together to produce harmony, and there is both the joy and the lesson for us."

Mr. S. W. G. Ford, president of the National Union of Mineworkers, was rather more succinct when he came to present the awards to the winners of the first section. "This is no time for speeches," he declared. "There have been sufficient speeches in the Yorkshire coalfield this week to last a long time."

Carlton Main Frickley Colliery band won the first section, Rawmarsh prize band the second, and Denby Dale brass band the third. Denby Dale received its award from Mr. F. Collindridge, secretary of the Yorkshire area of the NUM, after which the massed bands of Carlton Main Frickley Colliery, Markham Main Colliery, and Wharncliffe Silkstone Colliery, together with a massed miners' choir and guest soprano Jacqueline Delman gave a programme under the baton of Rae Jenkins.

PRAISE AND BLAME

Sir Thomas Moore Reviews Coal Trade

FINAL luncheon in the 1960/61 series in London of the Coal Industry Society on Monday gave Lt.-Col. Sir Thomas Moore, MP, chairman of Eastwoods, Limited, and subsidiary companies, the opportunity of reviewing the coal distributive trade from the point of view of the consumer, indirectly as a politician, and as a kindly and humorous critic of the previous three speakers—Mr. Alfred Robens, chairman of the National Coal Board, Mr. Sidney Ford, president of the National Union of Mineworkers, and Mr. John Hay, Joint Parliamentary Secretary of the Ministry of Transport.

His concluding peroration was: "I trust that Mr. Robens can stimulate production to that point when all who use coal and distribute it may rely on its availability at the time it is wanted and thus share in his cheerfulness. I trust Mr. Ford will persuade his members that without their wholehearted co-operation the great industry to which they belong will assuredly fail; and I trust Mr. Hay will remind the railways that coal has provided their main source of revenue for generations past and if they aid and abet its demise they will find little compensating joy in the tolls they collect from oil."

Early in his speech, Sir Thomas expressed his own view that coal being indigenous must always be the basic source of Britain's heat and power—if only for strategic reasons. As for nuclear power he felt it would be many generations before that form of energy became a serious challenge.

Must Watch with Vigilance

Speaking as an industrialist coal consumer, Sir Thomas said that his prime object was to manufacture goods of a quality and price that would find a ready sale both in the home and oversea markets. The better the goods, the more competitive the price, and the more reliable the delivery the better the goods would sell—and the more prosperous the industrialist's business would become. It was as simple as that—but to achieve that result one had to watch with vigilance every stage of production.

The stage that interested them all was power—its availability, reliability, and economy, because the efficiency of most works depended upon the power supply.

Until quite recently, coal in some form or another was the automatic choice—it was plentiful, cheap, and had no reasonable alternative. Today, it was still the major choice—but it had lost ground and had continually to justify itself against rival claims.

They must therefore face the question—what must the producers and distributors of coal do to maintain and improve its position and retain a fair share of the power market.

Mr. Robens had said that in the past 10 years the NCB had spent £2,500,000,000 in plant and materials alone—an immense capital investment—and he (the speaker) conceded that there had been vast improvements in both the production and selling techniques by the NCB and coal distributors. And he gave full marks to the Coal Utilization Council and the Coal Industry Society in their efforts to promote the efficient use of solid fuel.

Particularly, as a manufacturer, he congratulated the NCB's establishment of a technical corps of visiting representatives—a very real sales promotion effort. It showed faith in the product, in the future, and a real constructive drive to meet the present threat of oil; nevertheless he was still worried.

There had been an immense improvement in coal preparation in the past few years, but one point still gave cause for concern—analysis. From time to time he received alarming reports of the variation shown in the analysis of current supplies against the expected analysis. In a recent report it was stressed that at one works alone there was a 2 per cent. moisture deterioration which would add £1,000 to costs at that works alone.

He went on to maintain that coal usage today was not cheap for the user. Although in most cases it might be proved cheaper than its rivals, it was getting mighty close to its rivals on costings.

Commenting on the NUM requirement in the way of a national fuel policy, the speaker said that it appeared the NUM envisaged some sort of control of fuel usage. "It seems astonishing to me that after 14 years and the expenditure of a fantastic amount of capital such a suggestion should be made," he said. "If this proposal means a restraint on manufacturers in choosing their source of power, how on earth can they be expected to compete in foreign markets?" he asked.

Last September's increase in coal prices by the NCB was "thoroughly deplored," by Sir Thomas Moore. To make the increase within a few weeks of the normal winter increase seemed "an act of psychological and economic lunacy"—and just at the time when the trade was trying to get as much fuel as possible into consumers' cellars or silos. "As a piece of tactless management, that timing of a public price increase is in a class of ineptitude by itself," he said.

Nor did Sir Thomas let the supply position pass without comment. "Isn't it ridiculous," he remarked, "that after a reasonable 'coal winter' distributors have been balanced on the edge of a breakdown in supplies?" But for the fortuitous availability of coal dumps it would have been a disastrous winter for those valuable people who relied on solid fuel for their heat, their comfort, and their power.

Coal must form the basis of British industrial prosperity, but to maintain that position and to withstand the intrusion of other mediums of power, the coal industry must meet service requirements—without which no industry could maintain its place.

IRONWORKS is to be erected near Nador, Morocco, for the Bureau d'Etudes et de Participations Industrielles.

Personal

IEE Honour for Lord Nelson

IN recognition of his outstanding contributions to the development of electrical science and engineering, the Council of the Institution of Electrical Engineers, at its meeting last week, elected to honorary membership Lord NELSON OF STAFFORD, chairman of the English Electric Company, Limited.

LORD NELSON OF STAFFORD

Lord Nelson joined the Institution in 1905, was elected vice-president in 1950, and its president in 1955. During the year 1957-58, he achieved the rare distinction of serving as president of both the Institution of Electrical Engineers and the Institution of Mechanical Engineers. He has also been president of the Locomotive and Allied Manufacturers' Association (1958), and of the Federation of British Industries (1943-45).

Lord Nelson's association with English Electric began in 1930 when he was appointed its managing director. Three years later he became chairman. Previously with the British Westinghouse Company, Limited, (later Metropolitan-Vickers Electrical Engineering Company, Limited), he established and became manager of its Sheffield works.

Mr. A. J. HOWELLS, chief engineering draughtsman, South-Western Divisional Coal Board, has retired after 51 years in the mining industry.

Home sales manager of the gear division of David Brown Industries, Limited, Mr. ARTHUR RICHARDSON has completed 50 years' service with the company.

Reappointment of LORD CHANDOS as president of the association and Mr. G. COLLINGWOOD as chairman for the ensuing year, is announced by the Locomotive and Allied Manufacturers' Association.

Secretary and director of Tweedales & Smalley Limited, textile machinery makers, of Rochdale (Lancs), Mr. J. G. DOULL has resigned. He is succeeded as secretary by Mr. C. E. SALTHOUSE.

Sales manager of the foundry and engineering division of Armstrong Whitworth (Metal Industries), Limited, Gateshead, Mr. K. WALKINGTON is to make a European tour from March 12 to 25.

Visit to Israel, to discuss the possibility of building a new factory at Tel Aviv, is being made by Mr. A. J. NEWMAN, chairman and managing director of Newman Industries, Limited, electric motor manufacturers, of Bristol.

Dr. JULIUS A. STRATTON, president of the Massachusetts Institute of Technology, has been awarded the Institution of Electrical Engineers' Faraday Medal for his contributions to technological education and for his research in radio communications.

For his many services to the town, a presentation has been made to Mr. EUGENE CROSS (64), on behalf of the people of Ebbw Vale. For many years personnel manager at the Ebbw Vale works of Richard Thomas & Baldwins, Limited, Mr. Cross still acts in various capacities for the firm. He founded the Ebbw Vale Miners' Welfare Scheme in 1923 and is a member of nearly every organization in the town.

New appointments by the Minister of Pensions and National Insurance to the Industrial Injuries Advisory Council include that of Mr. WILL PAYNTER, general secretary of the National Union of Mineworkers and a member of the TUC general council.

Joint managing director of J. Parkinson & Son (Shipley), Limited, machine tool manufacturers, of Shipley (Yorks), Mr. EDWARD PARKINSON has retired after 46 years with the company, which was founded by his grandfather nearly 100 years ago.

Director and general manager of Steel Peech & Tozer, branch of the United Steel Companies, Limited, Mr. T. S. KILPATRICK, has been elected president of the works social services organization. He will take office at the annual meeting on April 24.

Cllr. ERNEST BUCKLEY, chief sales accountant with the North-Western Divisional Coal Board, has been elected next chairman of Saddleworth (Lancs) Council, of which he has been a member for many years. He was formerly a member of the executive board of Lancashire Associated Collieries.

Sir HENRY SPURRIER, chairman and managing director of Leyland Motors, Limited, together with Mr. D. G. STOKES, the company's sales director and managing director of Scammell Lorries, Limited, left for Johannesburg on Saturday on an extended business trip through south, central, and east Africa.

Pioneer in the crusade for smoke abatement, Mr. HAROLD E. PEARSALL, managing director of John Thompson (Triumph Stokers), Limited, coal handling plant manufacturers, of Wolverhampton, has retired. Mr. Pearsall organized the first smoke abatement classes for boiler-firemen, which led to the national City and Guilds course.

Scottish secretary of the Iron and Steel Trades Confederation since 1946, Mr. JOHN LANG has retired. He is succeeded by the assistant secretary, Mr. JOHN IRVINE. Mr. Lang is a former chairman of the Scottish Trades Union Congress and is the present treasurer. He is also chairman of the Scottish Board for Industry and a member of the Scottish Council (Development and Industry).

Manager of the central engineering shops of the steel division of the Steel Company of Wales, Limited, since 1953, Mr. RAY JENKINS has retired after 45 years' service with SCOW. He started his career with Guest, Keen & Nettlefolds, Limited, Cwmbran, in 1908. In 1913 he transferred to Tirpentwys Colliery (Mon). He joined the fitting shop of Baldwins, Limited, Margam, in 1922 and took charge of the shop six years later. When the SCOW central engineering shop was brought into operation in 1949 he was appointed planning engineer.

Engineering Orders Maintain High Level

FLOW of orders to the engineering and electrical goods industries during the closing months of 1960 maintained the same steady rate that had obtained since the end of April. By the end of the year deliveries had reached the level of net new orders. Exports of the industries during 1960 were 8 per cent. higher than in 1959. Order-books rose by 16 per cent. during the year.

The volume of production in the industries in the fourth quarter of 1960 was 4 per cent. more than a year earlier. This compares with a 10 per cent. increase during 1959.

French Steel Market

STABILITY AT A HIGH LEVEL

From Our Special Correspondent

ORDERS received by the French steel industry during the current year have been slightly above the average monthly level of 1960, which was itself 7 per cent. higher than the 1959 average. The salient feature shown by order-books is an overall high-level stability, with a few weak points. Delivery dates lie between three and six months, according to product, tonnage, and mill. Indications point to a rebuilding of stocks by the steel using industries, although the present volume of stocks can be considered as normal in view of the sharp increase of activity in these industries since the beginning of last year.

On the home market, joists and beams are in good demand as activity continues high in the field of metal fabrication and steady progress is made in the French railway's electrification programme. The introduction of a new type of European parallel flanged beam is contributing to the developing use of steel in metal fabrication.

With the building industry still affected by the seasonal winter slow-down, demand for concrete reinforcing bars is rather slack. The market for wire rod, however, shows more favourable conditions.

Advance in Tube Orders

The wire drawing industry has registered large orders as demand for wire for agricultural purposes has increased. Merchant bars (other than concrete reinforcing bars), are also in good demand, as well as hoop and strip, hot or cold rolled. In the hot rolled category, large orders are being received from the tube industry, with the market for welded tubes of small diameter proving firm.

An impressive recovery has been made in the field of tubes for pipe lines as a result of the new programmes decided upon for the Sahara (Oharnet-Hassi Messaoud) and metropolitan France (Lavera-Strasbourg). This, as well as a marked recovery in the boiler making industry, has accounted for a notable increase in demand for plate after a long period of weakness.

With the seasonal improvement in the car market, manufacturers have been passing larger orders for sheet. In other sheet-using industries trends are contradictory, being favourable in the metal drum and office equipment sector, and level or irregular in durable consumer goods, with the exception of refrigerators, both home and export sales of which are developing. There is a satisfactory market for special alloys and stainless steels.

Orders from export markets have been higher than the 1960 monthly average, and forecasts made by the large steel-using industries, particularly the mechanical industries which expect an increase of 7 per cent. in activity, incline to be confident that the current year should allow the steel mills to work near to full capacity, with an output of about 18,000,000 metric tons.

WATER TREATMENT engineers, William Boby & Company, Limited, Rickmansworth (Herts), has appointed Edgar Arrigo, Limited, as its agent in Malta.

£14,000,000 Rise in UK-East German Trade

IMPORTS of machine tools from East Germany into the UK are to rise from £55,000 to £295,000 under the new bilateral trade agreement for 1961 between the two countries. Total trade between the UK and the German Democratic Republic will increase by 28 per cent.—from £14,000,000 to £18,000,000. Last year Britain exported goods worth £7,000,000 to East Germany and imported £6,300,000-worth of goods from there.

Britain's exports of iron and steel and non-ferrous metals accounted for £3,500,000, those of machine tools for £220,000 and those of chemicals for £200,000. Under the 1961 agreement, the UK will send glass-making machinery worth £200,000, agricultural machinery worth £100,000, and printing and packaging machinery worth £100,000 to the GDR, while export quotas for chemicals have been increased from £175,000 to £400,000, and those for measuring, testing and other scientific equipment from £115,000 to £200,000.

NEW ERA COMMITTEE MEETS

INAUGURAL meeting of the divisional committee No. 3—that dealing with switchgear and transformers for power supply—of the Electrical Research Association was held recently. The committee is under the chairmanship of Mr. J. Christie, A. Reyrolle & Company, Limited.

Other members include:—Mr. J. S. Cliff, General Electric Company, Limited; Mr. J. M. Ferguson, English Electric Company, Limited; Mr. C. H. Flurscheim, Associated Electrical Industries (Manchester), Limited; Mr. R. M. Hobill, Ferranti, Limited; Mr. H. Leyburn, A. Reyrolle & Company; Mr. A. E. Nicol, Hackbridge & Hewittic Electric Company, Limited; Mr. E. C. Rippon, C. A. Parsons & Company, Limited, and Mr. T. W. Wilcox, Mertz & McLellan.

Dr. H. G. Taylor, director of the ERA, is an ex-officio member, and Major E. D. Gardner, ERA, is secretary of the committee.

INDIA EXPORTED 325,000 metric tons of scrap in 1960, which earned foreign currency equal to Rs. 60,000,000. This figure is the highest since 1953, when 392,000 tons were exported.

Law Cases

Court of Appeal Trebles Widow's Damages

WIDOW of a man killed in an accident at the Sheffield works of Sanderson Bros. & Newbould, Limited, had the damages previously awarded trebled by the Court of Appeal. Mr. Richard Leeming (47), was killed when he fell through an open manhole into a vat of boiling chemicals at the works. At Sheffield Assizes, Mr. Commissioner Fenton-Atkinson held that Mr. Leeming had been two thirds to blame for the accident and awarded damages of £1,015 and costs to the widow.

Giving judgment, Lord Justice Sellers said that there were many possibilities for the accident without negligence by Mr. Leeming and the better view was to hold the employers solely liable. Lord Justices Willmer and Donovan agreed and the court entered judgment for Mrs. Leeming for £3,045.

The company was refused leave to appeal to the House of Lords.

£3,143 DAMAGES FOR PIT HAULIER

DAMAGES of £3,143 against the National Coal Board were awarded by Mr. Justice Stephenson at Monmouthshire Assizes to Mr. Morgan Davage (59), for severe head injuries sustained in an accident at Big Pit, Blaenavon (Mon), in 1957, when he was employed as a haulier at the colliery. The accident occurred while Mr. Davage was delivering timber to the coal face. A horse-drawn tram, being driven by Mr. Davage, stopped in a narrow part of the pit and he had climbed over the tram to see what had made the animal stop, but the horse bolted knocking him down and pulling the tram over him.

It was stated that the mine roadway where the accident occurred was so narrow that Mr. Davage had no chance to stand aside and avoid being hit.

MINER LOSES DAMAGES CLAIM

CLAIM for damages against the National Coal Board by Mr. Kenneth Biggs (34), was dismissed at Monmouthshire Assizes. Mr. Ryder Richardson, for Biggs, submitted that the board had been negligent in failing to instal safety measures on tramlines at Oakdale Colliery, where Biggs worked as a greaser. Biggs was injured when hit by a tram as he crossed from one side of the lines to the other.

Mr. Ralph Cusack, for the board, said Biggs should have looked in the direction of the oncoming trams before crossing. There was a good view of the line for several feet. Mr. Justice Stevenson found that although the area was a dangerous place in which to work, it was Biggs' negligence that led to the injury.

Two 17-year-old miners, Charles Ernest Johnstone Robertson and Robert Bryant Burns, were put on probation for a year at Ayr Sheriff Court for being disorderly in No. 3 Pit at Barony Colliery.

SWING GRINDER, Mr. Arnold Hudson (50), who had his toes broken when a steel billet fell on his foot at the Sheffield works of the Titanic Steel Company, Limited, was awarded £405 damages at Sheffield Assizes.

BOTH the plaintiff, Mr. Mathew Joseph Shaw (61), and the defendants, Stanton Ironworks, Limited, were equally to blame for an accident in which Mr. Shaw was involved, it was decided at Nottinghamshire Assizes. Of the £350 special damages and £450 agreed damages Mr. Justice Phillimore awarded the plaintiff £400.

DAMAGES of £246 10s. were awarded at Sheffield Assizes to Mr. Douglas Hart (43), who sued Owen & Dyson, Limited, wheel and axle makers, of Rotherham, for personal damages as a result of an accident in which he lost two fingers. The court held the plaintiff one third to blame for the accident and awarded costs against the company.

CLAIM FOR DAMAGES by a Leeds miner against the National Coal Board was settled at Nottingham Assizes when Mr. Justice Pilcher approved a settlement and gave judgment for £5,950 with costs to Mr. James Costello (58). Mr. Costello was stated to have injured his back in an underground accident at Shirebrook Colliery in 1956, and had done only 12 weeks' work since.

AT NOTTINGHAM ASSIZES Mr. Justice Phillimore awarded damages of £250, plus £62 12s. special damages, to Mr. Roy Moakes (41), a machine operator, who lost an inch of a middle finger in a boring machine. Mr. Moakes alleged negligence and breach of the Factories Act against his employers, Sheepbridge Alloy Castings, Limited, of Sutton-in-Ashfield, a subsidiary of Sheepbridge Engineering, Limited.

Davy & United Order Worth £1,000,000

WORTH about £1,000,000, an order has been received by the Davy & United Engineering Company, Limited, a member of the Davy-Ashmore, Limited, group, from Shelton Iron & Steel, Limited, for the design, supply and installation of oxygen-blown Kaldo furnace plant at its Etruria works, Stoke-on-Trent.

Davy & United will also be responsible for the overall engineering of the whole of this project, which will comprise the first complete steel melting shop in the UK to use only Kaldo furnaces. These furnaces will have a capacity of 55 tons of liquid steel at each charge.

The engineering, layout, and design of the plant will be undertaken by the steel processes division of Davy & United Engineering and a substantial proportion of the contract will be manufactured in the Stockton works of the Davy-Ashmore group.

Mersey Salvage of Ravenscraig Steel Castings

WORK is progressing on the recovery of the two giant castings for the Ravenscraig steelworks of Colvilles, Limited, which sank in the Mersey estuary when the ship in which they were being carried capsized. A spokesman for the company said that it was not expected that the 144-ton castings—each 38 ft. long, 18 ft. wide, and 17 ft. deep—would be damaged by the immersion.

If the accident delayed the commissioning of the slabbing mill the whole Ravenscraig project was unlikely to be affected, he added. The strip mill itself would not be ready until a year later.

F. H. LLOYD & COMPANY, LIMITED—Mr. A. C. Corbett has been appointed to the board.

European Coal Output

SLIGHT FALL IN 1960, BUT IMPROVED DEMAND

OUTPUT of hard coal in Europe fell in 1960, for the third successive year. Total European output (excluding that of the USSR) reached 590,000,000 metric tons—a reduction of 7,000,000 tons (1.2 per cent.) compared with the 1959 level, according to figures issued by the United Nations Economic Commission for Europe (ECE). In 1959 output fell by 17,000,000 tons, or 3 per cent., below the 1958 level. At the same time there was an improvement in demand for coal during 1960, and this resulted in a reduction in stocks of unsold coal at pithead.

In Western Europe, pithead stocks fell from 67,000,000 tons at the start of the year to 58,000,000 tons by the end. During 1959, pithead stocks rose by 22,000,000 tons. Levels of pithead stocks at the end of December were—Belgium, 6,600,000 tons; France, 13,300,000 tons; Netherlands, 700,000 tons; West Germany, 7,100,000 tons; United Kingdom, 29,800,000 tons. In Poland, pithead stocks, at 260,000 tons, were at normal levels.

The fall in production was most noticeable in the UK, where output was down by 12,700,000 tons, and in France (down 1,600,000 tons). In other western European countries, apart from the Netherlands, where there was a rise of 500,000 tons (4.3 per cent.), output was very close to the 1959 level. Output rose in Poland (up 5,300,000 tons), and in Czechoslovakia (up 1,300,000 tons). In the USSR output of hard coal and lignite rose by 6,500,000 tons (1.3 per cent.) to reach a new record of 513,000,000 tons.

Decline in Imports

Imports of hard coal by western European countries (from within and without western Europe) totalled 56,000,000 tons in 1960 compared with 58,000,000 tons in 1959. Imports from West Germany, the Netherlands, Poland and the UK rose compared with 1959, while imports from all the other principal sources of supply were unchanged or declined. Imports from the United States amounted to 14,500,000 tons compared with 17,000,000 tons in 1959.

France was the largest hard coal importer in 1960 (10,000,000 tons, compared with 11,400,000 tons in 1959). Italy followed with 9,800,000 (8,300,000) tons, and the Netherlands took third place with 7,200,000 (6,600,000) tons. West Germany imported 6,800,000 tons. In 1959 West Germany imported 10,000,000 tons, including 3,000,000 tons from the Saar.

Principal importers of United States coal in 1960 were: Italy, 4,400,000 (4,900,000) tons, West Germany, 4,400,000 (4,100,000) tons, the Netherlands, 2,100,000 (2,600,000) tons, Belgium, 800,000 (1,000,000) tons, France, 600,000 (800,000) tons, Austria, 700,000 (800,000) tons, Sweden, 600,000 (700,000) tons, and Switzerland, 400,000 (500,000) tons.

The ECE Quarterly Bulletin of Coal Statistics for Europe covering the first nine months of 1960, which is to be published shortly, will contain figures on production and trade in coal and other solid fuels, data on employment and productivity in European mines, stock availabilities and conversion of hard coal and brown coal into coke and briquettes, and deliveries of solid fuels to various consumer groups, it is stated.

Saving the Coal Exchange

IT was decided at a meeting of the Victorian Society held last week in London, that a committee should be formed to make further approaches to the Ministers of Housing and Local Government, and Transport, to save the Coal Exchange, which is scheduled for demolition under the present plan for road widening in Lower Thames Street. The committee of six will consist of Mr. B. Batsford, MP, Mr. John Betjeman, Lord Mottistone, Sir Albert Richardson, Mr. P. Chamberlain, and Mr. C. S. Chettoe.

At last Friday's meeting several suggestions were made, but representatives of the City Corporation took the view that none of the suggestions was new. Mr. H. A. Mealand, the City Planning Officer, said the City Engineer was satisfied that the only possible road which could serve the traffic needs had to go through the Coal Exchange. "The question before you, therefore, is where else the building can be put up and who will pay for it to be moved," he said.

The Coal Exchange is one of the earliest buildings in the world where cast iron was not only used structurally, but expressed architecturally.

Broken Hill's Output Rises but Fails to Match Demand

INCREASED production and heavier demands for its products are reported for the six months ended November, 1960, by the Broken Hill Proprietary Company, Limited, of Australia. Output of steel ingots rose by 7.1 per cent. and coal output by 21 per cent. Pig-iron production was 12 per cent. higher and coke production showed an 11 per cent. increase.

The company could not meet all the demands for its products, but the half-year report states that there are signs of a levelling-out in demand. During the six months £A20,000,000 was spent on capital works and reconstruction, but all major centres of manufacture are facing labour shortages, which affect expansion plans.

The following are production figures (in tons) of the Broken Hill Proprietary and Australian Iron & Steel Pty., Limited, for January:—Coke, 210,177; pig-iron, 231,046; steel ingots, 249,245; bloom and slab mills, 224,668; heavy and continuous mills, 133,029; plate and strip mills, 84,456; merchant mills, 86,204; rod mill, 10,435; cold rolling mills, 2,420; tinplate, 9,163; steelfoundry (excluding ingots), 90; iron foundries, 4,593; spun pipes, 5,750.

More Pit Mechanization to Meet Oil Threat

MORE mechanization to increase productivity, and enable coal to fight the battle against oil, is on the way, Mr. James Anderton, chairman of the North-Western Divisional Coal Board, told members of the Lancashire Consultative Council.

MR. J. ANDERTON

Addressing the recent winding-up meeting of members of the former Manchester, Wigan, and St. Helens Area councils, Mr. Anderton said that during the past three years productivity had increased by 17 per cent. in the North-Western Division, compared with an average of 12 per cent. for the country. Over these years, however, contraction had taken place in the mining industry and the principal reason was the effect the new source of power—oil—had on the coal industry's trading.

The demand for power was still going up, the chairman added, but oil competition was increasing every year. Higher wages and salaries would have to be paid and, in the meantime, the coal industry was trying to hold the markets on price alone against oil. "There is only one answer to it and that is increased productivity—and the only sure way to increase productivity is by mechanizing the mines," Mr. Anderton said. "This will put something in the kitty for the National Coal Board to meet the demand for higher wages and rewards to which the men are entitled."

The three Area councils have been wound up following the reorganization of the Lancashire Areas. The chairman thanked the members for their work and was supported by Mr. Joe Gormley (NUM), Mr. W. Grundy (NACODS), Mr. J. C. Woodward (BACM), and Mr. G. W. Sanders (NACM).

DSIR RESEARCH FELLOWSHIPS

TOTAL of 39 research fellowships have been awarded to start during the present academic year by the Department of Scientific and Industrial Research and by the DSIR on behalf of the North Atlantic Council. Among those receiving DSIR awards for post-doctorial research in science and technology, are Mr. M. F. Ashby, who receives a research fellowship in metallurgy at Cambridge University, and Mr. P. E. Secker, whose fellowship is for electrical engineering at Queen Mary College, London University.

Under the NATO Science Research Fellowship scheme, which is financed by the North Atlantic Council and administered in the UK by DSIR, Mr. N. Birks receives a research fellowship in metallurgy at the Max-Planck Institut, Göttingen, Germany.

WOODHOUSE & RIXSON, LIMITED—Mr. Raymond Bates, sales manager, has been appointed to the board. His father, Mr. E. H. Bates, general manager, recently completed 65 years with the company.

Advance in Coal-fired Boiler Design

WHAT is claimed to be the first coal-fired shell-type boiler with output and efficiency equal to a comparable oil-fired one has been produced by Cochran & Company Annan, Limited. Mr. J. S. B. Lea, managing director, announcing the development, said that this gave coal "its first decent chance to compete on equal terms with oil" for this type of boiler. Using low-grade coal the boiler is claimed to have an efficiency of about 80 per cent. on the gross calorific value. Annual savings on the fuel bill of a small boiler are estimated at up to £600, compared with oil firing.

Five of these, the largest boilers made by the company, are to be installed at the new factory of the British Motor Corporation, Limited, at Bathgate. The plant has been designed in close collaboration with the National Coal Board and includes coal-handling plant, a motorized dragline, and automatic tempering of the incoming coal. Each boiler will burn approximately 1.8 tons of low-grade coal—untreated smalls, containing over 40 per cent. fines—an hour.

The boilers will be stoked automatically with a corresponding automatic ash discharge. The discharge will go directly to an ash conveyor, which will also receive the discharge from the grit arresters. Vacuum equipment will be used to clean the combustion chambers of the boilers.

Holman's Convert Drills for Kellingley Shaft-sinkers

WHEN it broke all British shaft-sinking records at Kellingley Colliery recently, the Thyssen Shaft Sinking Company, Limited, had to overcome considerable difficulties to accomplish the feat.

In the early stages of the operations, "frozen ground" through which the sinking was taking place, caused great difficulty in withdrawing the steel drills. After consultation with Holman Bros., Limited, whose equipment was being used, the Silver Three Handrils were specially converted to allow for high volume independent blowing which overcame this problem.

For the sinking operations, three shifts were employed each using 10 Holman Silver Three Handrils and 73 holes varying between 8 ft. and 10 ft. in depth were drilled per round. The average drilling time per round was 1¼ hours.

SHINY OLD IRON

CACHE of nails left by the Roman legions in Britain, which was discovered recently near Spittalfield (Perthshire), is to be analyzed at the central research station of Colvilles, Limited, at Motherwell. The nails are in an excellent state of preservation.

A spokesman for the Iron and Steel Institute, which is handling the investigation, said: "We want to examine the method of construction and to find out what has prevented corrosion."

RUGBY PORTLAND CEMENT COMPANY, LIMITED—For the 15th successive year the net profit is a record—at £1,138,908 (£970,704), after tax of £638,000 (£520,000). The dividend for 1960 is raised from the equivalent of 21⅞ per cent. to 25 per cent.

Coal will meet strong competition from oil for at least the next 20 years and the coal-mining industry has to decide what it is going to do about it. In this article, the author, who is Senior Lecturer in Coal Mining, School of Mines and Metallurgy, University of Otago, Dunedin, New Zealand, indicates the general trends in world coal production.

FUTURE FOR COAL

Review of World Competition from Oil

by W. B. WATSON

IN the last few years the rate of increase in world coal production has fallen off. There has been a change in the distribution of coal production, with a rapid rise in China and in the USSR and a decline in the US. There is taking place a continuous rise in energy production throughout the world and oil and natural gas, as shown in Table 1, are providing a large share of this increase. While world production of coal is not declining, its share of the energy market is decreasing in nearly all parts of the world in favour of oil and it is expected that this trend will continue.

Countries planning significant increases in coal production are China, India, and the USSR, but in the USSR greater reliance is to be placed on oil and the percentage contribution of coal is planned to fall. The coalfields of the USSR are not conveniently located to centres of consumption. Rail hauls up to 500 miles are not uncommon and a high proportion of coal produced is consumed in transporting coal.

Oil pipelines will simplify the transport of energy and this is probably a factor in the greater emphasis to be given to oil.

China is at present relying mainly on a rapid increase in coal production, but some coal, together with oil shale and peat, is being used for the production of synthetic liquid fuels. No doubt China, too, will in time place less emphasis on coal and more on oil.

There are many estimates of ultimate reserves of coal and oil in the world. Two recent estimates* made by the oil industry which are not likely to overestimate coal reserves nor underestimate oil reserves are: Oil reserves by conventional methods of production, 1,900,000 million barrels, and coal reserves as oil equivalent, 55,000,000 million barrels; and oil reserves, 1,250,000 million barrels.

Oil consumption is increasing and an average rate of 7½ per cent. per annum from 1950-58 was recorded. Estimates of the rate of increase in the future vary for different parts of the world, but range around 5 per cent. per annum. If this rate of increase is maintained, oil reserves will approach exhaustion by the year 2000. Oil production will not continue to rise and then cease abruptly, but will rise to a maximum and gradually fall off.

At some time between now and the year 2000, it is reasonable to assume that costs of oil production will begin to rise.

It is permissible to use global figures as a basis for oil planning in the immediate future. The oil industry has an international character, with export of oil to centres of energy consumption a normal feature and many oil companies are international. Sources of oil are becoming more diversified and the problem of supplies from the politically unstable Middle East is less serious; the USSR has now entered the international oil market. However, there is a tendency for oil-producing countries to demand a larger share of the profits of oil production and in some countries the threat of nationalization hangs over the oil industry. Also, when oil supplies become less freely available in the future, national considerations will influence their distribution.

Proved reserves of oil are 291,000 million barrels, but only half is recoverable by presently known techniques and at present price levels. At the present production rate of 7,000 million barrels per annum, proved oil reserves represent 20 years' supply. The oil industry has at present

* World Petroleum Report, February, 1960.

TABLE 1.—*World Production of Energy in Millions of Tons of Coal Equivalent.*

Energy production.	Total.		Coal.		Oil.		Natural gas.	
	Production.	Increase.	Production.	Increase.	Production.	Increase.	Production.	Increase.
1955	3,295	—	1,807	—	1,029	—	400	—
1956	3,524	229	1,909	102	1,118	89	434	34
1957	3,684	160	1,968	59	1,175	57	471	37
1958	3,795	111	2,008	40	1,205	30	505	36

surplus productive capacity of from one third to one quarter of present production, but it is thought that this excess capacity will last only three to five years.

The inroads of oil and natural gas into energy markets previously supplied by coal has resulted in some countries in a gradual and in some cases a sudden reduction in coal production. The market for shipping is lost, that of railways rapidly being lost and competition is being encountered in gas manufacture, electricity generation, domestic heating, and steam raising. Only in coke manufacture does coal retain a monopoly and this demand fluctuates with the prosperity of the steel industry. The strength of the competition from oil and its effect on the coal-mining industry should not be underestimated.

From a consideration of present oil production, anticipated increases in production and estimated oil reserves, it appears that coal will meet strong competition from oil for at least the next 20 years. As the demand for petrol increases so does the availability of fuel oil. After about 20 years the cost of oil will probably start to rise and the energy market should move in favour of coal. After the year 2000 oil shale, tar sands, and coal will be increasingly required as a source of liquid fuels and coal should have little to fear from competition with oil.

However, nuclear power is likely to develop into a serious competitor to coal during the next 20 years. Consumption of electricity is increasing more rapidly than total consumption of energy. World consumption of electricity increased 77 per cent. between 1951 and 1958, whereas total consumption of energy increased 35 per cent. Nuclear power is at present essentially an electricity producer and, while not yet economic compared with coal-fired power stations, it is expected to become competitive in the near future.

The problem for coal is one of immediate readjustment to handle the decline in demand which has occurred in some countries, of meeting strong competition from oil over the next 20 years and of long-term planning to meet future energy demands.

Answer from Coal

Coal's answers to its problems vary with local conditions and the responsibilities of the coal-mining industry in different countries. Some of the proposed answers are discussed here.

Government Assistance.—Several reasons can be put forward for Government assistance for coal-mining industries. They are essentially national and supply mainly home markets. Privately owned coal-mining companies are small and national in comparison with international oil companies. There have never been large international coal-mining companies and now, in many countries, coal mining is either Government-owned or subject to Government control. Coal during and immediately following the second world war was a military and economic weapon in the struggle for survival. Coal became a national symbol and it is natural that it should turn to the Government for assistance now that it is meeting difficulties.

During the post-war coal shortage in Great Britain the coal-mining industry was exhorted to produce maximum tonnage and many uneconomic units were kept in production. Coal prices were controlled by the Government and coal which could have been exported to Europe at high prices was retained for home consumption. High-priced coal was imported and the loss on sale in Great Britain carried by the National Coal Board.

Government Assistance

Government control prevented the building up of financial reserves during the seller's market. Now a buyer's market exists, the coal-mining industry does not have the financial reserves to meet it, and adopts the attitude that since it was hindered by the Government when the market was in its favour, it should be assisted now that the market is against it. This is a reasonable argument, but the coal-mining industry should remember that Governments, like other bodies and individuals, have short memories. The demand for Government assistance takes the form of a request for subsidies for coal and a tariff or quota on imports of oil. Protection against imported oil has been requested in many countries.

A further argument in favour of protection is the safeguarding of investment in the coal-mining industry and associated Government, municipal, and private investment in the coalfields. The ghost town has long been a feature of metalliferous mining, but coal mining usually takes deeper roots and the loss of employment and source of local revenue is more serious in the permanently settled communities associated with coal mining. A Government is given a difficult choice of action. It cannot permit the social dislocation caused by the abandonment of a previously prosperous area, neither can it subsidize indefinitely a section of the country and community. It can encourage the development of alternative industries and at the same time give sufficient assistance to coal mining to permit a controlled run down, but not enough to encourage uneconomic expansion.

Alternatively, the Government can risk further losses by giving substantial assistance to the coal-mining industry in an attempt to make it competitive with other sources of energy. Unfortunately, this choice of action brings coal mining into politics, so that although the deciding factor should be the overall economic welfare of the country, decisions may be based on political theories.

Another reason advanced for Government assistance is that production of energy from indigenous fuel reduces reliance on imports. These may be difficult to obtain in times of international unrest and are always a debit in a country's external balance of payments. The argument of self-sufficiency probably has little bearing on national security in this age of nuclear weapons and, according to economists, a drive towards national self-sufficiency leads only to economic ruin. Consumers are entitled to the cheapest fuel available, and this is particularly important for countries

exporting manufactured goods in which fuel is a high element of cost.

It is also claimed necessary to maintain a body of trained miners for future production. This argument is over-emphasized, as there is no suggestion that coal mining will cease in any country. In any case, other mining will continue and many techniques are interchangeable; it has also been shown on many occasions how quickly miners can be trained.

Competition with Oil.—In competition with oil, coal is up against the obstacles of price, convenience, and reputation. With reduced production and without the necessity for maximum output of coal irrespective of cost, the capacity that remains in the coal-mining industry should lead to greater efficiency and it should be possible to mine coal at a lower price, thus being more able to compete with oil.

This may not be the case immediately. When the industry is laden with the costs of readjustment —closing down mines, writing off losses, stockpiling, redundancy payments, etc., and with overheads spread over a smaller tonnage—coal prices may rise. This happened in Great Britain, where the price of coal was raised by 5s. to 10s./ton in September, 1960. However, much can be done to reduce prices by increased mechanization. Coal prices in the US have remained steady since 1948 despite a general rise in prices, and in Great Britain the NCB held prices steady for three years prior to the recent increase. Whether coal can compete with fuel oil is questionable as fuel oil does not carry its fair share of production costs, but is disposed of as a by-product of petrol. Finally, it must be remembered that the cost of coal to the consumer includes transport costs, and reduction in the pithead price of coal become less significant when the delivered price of coal is considered.

It is doubtful if for all consumers the choice between oil and coal is based solely on cost. Many consumers prefer oil because of its greater convenience in burning control, storage, handling, and smokeless properties.

For about 20 years, from 1939 onwards, coal was in short supply and yet it appeared to the average citizen that there was coal in the ground if only the miners would dig it out. There was also a shortage of oil, but in many countries this was imported and the shortage was associated with the war effort and the external balance of payments; it was not identified with the oil industry. Without reviewing the merits of these attitudes, there is no doubt that the coal-mining industry earned a reputation as an unreliable producer. This reputation has lingered, to the detriment of coal and the benefit of oil. The idea has also been fostered that oil is a modern fuel whereas coal is outmoded, and cost comparisons are made between modern oil-burning appliances and obsolete coal-burning appliances.

Fortunately, the coal-mining industry in many countries is beginning to realize the importance of good public relations and is also beginning to offer a consumer service comparable with that of oil. Standards of coal preparation are being raised and loans are available to enable coal consumers to install modern plant. With reduced prices, fair competition and modern utilization equipment, coal is a more economic proposition than oil in many markets.

Exports.—Some countries are looking to exports as a solution to their coal problems. Coal can be exported under three conditions:

(1) Where the delivered price of imported coal is cheaper than home produced coal. This happened recently with US coal exports to Europe, when there was surplus production in the importing countries. It depends largely on prevailing shipping rates.

(2) Where the importing country is short of indigenous fuel. In this market coal is in competition with oil, which has the advantage of easier transport and, because of its association with petrol, better handling facilities.

(3) Where coking coal is required; *e.g.*, Japan is importing coking coal when its own coal-mining industry has a surplus productive capacity.

Only the export of coking coal offers any long-term possibilities, but the quantities are not large and competition is keen. Canada is subsidizing exports to Japan and even New Zealand, with inadequate harbour facilities, is exporting small quantities of high-quality coal to Japan at what is believed to be a loss.

Coal has never been an international commodity to the extent of oil. Great Britain once had an important export market which, at its peak in 1923, amounted to 35 per cent. of production. Its size depended largely on the earlier development of coal mining in Great Britain compared with other countries, *e.g.*, exports from Great Britain to Russia amounted to 6,000,000 tons in 1913 and, even as late as 1937, to 2,000,000 tons. Peak exports from the US were in 1957, but they amounted to only 16 per cent. of production. Poland and the USSR are now exporting coal to Europe at what are considered to be uneconomic prices in what appears to be part of the Soviet bloc's economic offensive.

Over the period of expanding oil production, exports cannot provide a large market for coal. Some countries may achieve temporary success, but only at the expense of the coal-mining industry in other countries, and subsidizing exports offers no long-term solution.

Conversion of Coal.—As oil and natural gas are preferred fuels in some markets, there has frequently been pressure from the coal-mining industry for this competition to be met by converting coal into oil and gas. Manufacture of oil from coal has been carried out for over 100 years, but, except in special circumstances, it has proved uneconomic. This has recently been confirmed in Great Britain, where a Committee on Coal Derivatives reported that it saw no immediate prospects for setting up an oil from coal industry. The hydrogenation plant of Imperial Chemical Industries, Limited, in Great Britain which converted coal and, later, creosote into liquid fuel, closed down in 1958

for economic reasons. The Fischer-Tropsch plant, which started operations recently in South Africa under the favourable conditions of coal at 6s./ton and a local market for refined waxes and chemical products, made a loss in 1959. The Wankie Colliery Company, Limited, has also announced that an oil from coal industry in the Federattion of Rhodesia and Nyasaland is at present not economic.

Gas production from coal has long been associated with the use of coking coal and, to a lesser extent, with the complete gasification of low rank non-coking coal. Manufactured gas and coal are being challenged in countries endowed with natural gas and in other countries by imports of natural gas transported by pipeline or refrigerated tanker.

As a general principle it seems unsound to meet competition from other fuels by changing coal into these fuels, as this allows coal's rivals to control the terms of competition. As coal will be required eventually as a source of liquid fuels, it would be appropriate if research into the manufacture of oil from coal were left to the oil industry. Coal is a solid and the coal-mining industry might do better to direct its research into the utilization of coal in this form.

Responsibilities of the Coal-mining Industry

Some of the problems of the coal-mining industry have been outlined, but before discussing its future it is necessary to decide the responsibilities of the industry. Coal mining has no intrinsic rights, but must substantiate a case for existence. Oil shale is another source of energy in a comparable position. At present, oil shale is not extensively mined because it is uneconomic. Vast known deposits of oil shale remain untouched, but there is no suggestion that they ought to be mined at the present time.

The coal-mining industry has a responsibility to its employees, especially in a locality where it is the main source of employment. There is also a responsibility to provide the continuity of supply of coal at a price that will not jeopardize coal consumers at the expense of those consuming oil. The industry also has a responsibility to shareholders or where the industry is State operated to taxpayers. However, if the industry's competitive position is limited in any way by the Government, then the Government must assume most of these responsibilities.

Finally, there is a responsibility to posterity, on either a national or international basis, not to waste natural resources and to produce coal when required. Whether the coal-mining industry should make forecasts of future demands for energy and plan productive capacity accordingly is questionable. In a free market if a shortage of coal develops, the price rises. This does not harm the coal-mining industry, whereas if there is overproduction the industry is damaged in both a controlled and free enterprise economy. For this reason the responsibility for forecasting future energy requirements and for any errors in the forecasts should rest with the Government.

The coal-mining industry has a choice of action in its competition with oil and natural gas. First, it can passively accept a declining demand and share of the energy market. This is not necessarily a defeatist attitude, but may be realistic. The more rapid the increase in oil consumption, the sooner will competition between coal and oil turn in favour of coal. Secondly, the coal-mining industry can accept the challenge of oil. This is to the advantage of fuel consumers, but it could jeopardize the future of the coal-mining industry if it involves mining easily won coal with little regard to conservation of reserves. Also it has been pointed out how difficult a price warfare between coal and oil would be due to the unfair pricing of fuel oil.

Finally, the coal-mining industry, while concentrating on established markets, can direct its resources and research into possible new avenues where it will not be in direct competition with other forms of energy. Action along these lines must take into account the increased production of small coal from mechanization, but demand for small coal has not kept pace with its increased production. One solution is to make briquettes, but this adds to the cost of the coal. Unless methods of mining can be changed to yield a higher proportion of large coal, it will be necessary to design coal utilization appliances for coal as it is produced. A revolutionary breakthrough here could have a significant impact on the demand for coal and on the coal-mining industry. Increased efficiency and similar improvements can never have more than marginal influence.

This raises the question of whether the coal-mining industry should take the initiative in finding new uses for coal, or whether its activities should be limited to producing coal. Some commodities, *e.g.*, wool and copper, have associations to foster and develop the use of the commodity in competition with substitutes and similar action to promote coal is possible. One drawback to the development of further uses for coal is the organization of the coal-mining industry, which in some countries is a handicap to vertical integration with coal-consuming industries.

The choice of action will depend on local conditions and the responsibilities of the coal-mining industry.

In many cases it will probably be a compromise of the various possibilities. Whatever choice is made, it is preferable that it shou'd be a positive decision and not a series of expediences with the industry in fact just drifting.

Regularity of Supply

One problem that worries coal users is the possible disruption of supplies. This makes consumers carry stocks and additional costs in the form of interest payments, handling charges, and space requirements increase the price of coal. Interruption to supply of coal can be caused by irregular deliveries of the transport system, *e.g.*, rail and shipping, and by dislocations to transport. It can also result from industrial disputes. Coal

miners have always been among the most militant industrial workers and mineowners have not always been the most reasonable employers, so that it is not surprising that interruptions to production have occurred. Fortunately, there now seems to be a realization by both sides of the industry that interruptions to production serve neither interests and only hinder competition which must be offered to oil.

The only general tendency in transport facilities has been a substitution of road transport for rail transport. For limited hauls road transport is cheaper and more flexible. However, railways are having difficulties and in some countries there are restrictions on the use of road transport where rail transport is available. This restriction may be to the overall economic advantage of the country, but it is unfair for the cost to be loaded on to coal. Railways are changing to oil and this market is lost to coal. It is therefore a double blow for coal to be denied the use of cheaper and more flexible transport in other markets because of protection given to railways.

Traditionally, users of coal have located their industries on coalfields to reduce the cost of coal transport, and the industrial concentrations of the Ruhr and parts of Great Britain have resulted. In the absence of conflicting factors a close geographical proximity of coal mines and coal consumers has much in its favour. New Zealand is in an unfortunate position, as the majority of coal production is separated from centres of coal consumption by distances running into hundreds of miles.

A development which provides a continuous uniform delivery of coal is hydraulic pipeline transport. This is used in the US for transporting coal 108 miles from a preparation plant to a power station, and also in France and the USSR. Now there are plans for a coal pipeline in Germany from the eastern part of the Ruhr to Regensburg in Bavaria, a distance of 300 miles, and in Great Britain the Central Electricity Generating Board is investigating this method of transport.

For the domestic market a recent innovation which places the regularity of supply in the consumer's hands is the marketing of small quantities of coal packed in paper bags. In Great Britain, the National Coal Board is offering bags of 28 lb. and it is intended that these should be available from slot machines. In New Zealand packaged coal, also in 28-lb. bags, was put on the market in 1959 and it found a ready sale in grocery shops and from garages. This method of supply assists flat dwellers, particularly those living above ground level and without adequate storage facilities. Unfortunately, this method of marketing increases the cost of coal, but experience indicates that this is acceptable to consumers if the coal is of high uniform quality.

Conclusion

This article gives personal views on the future of coal, based on a study of available information. It contains generalizations and may be wrong in specific coalfields or at specific periods of time. It tries to indicate the general trends in world coal production. There seems no doubt that coal will meet strong competition from oil for at least the next 20 years and the coal-mining industry has to decide what it is going to do about it.

The more study and discussion there is of this subject the greater chance does the coal-mining industry have of making the correct decisions.

Book Review

Kempe's Engineers Year Book, 1961. Edited by C. E. Prockter. Morgan Bros. (Publishers), Limited, 28, Essex Street, Strand, London, W.C.2. Two volumes, 87s. 6d.

NOW in its 66th edition, Kempe's has earned over the years an enviable reputation among engineers generally as an indispensable work of reference. It covers in 79 chapters almost every aspect of engineering used in its widest sense and includes as introductory to the main subjects a wealth of data in tabular and other convenient forms invaluable for dealing with queries involving first principles in the solution of technical problems. In view of the wide range of engineering covered, the task of revision is a heavy one and each section receives the attention of an eminent authority familiar with current developments. In the present edition sections which have been rewritten include "Forging Hammers and Dropforging Plant" and the heating section of "Heating, Ventilation, and Air-conditioning."

Major revisions also have been made to the sections "Heat, Optics, etc."; "Hydraulics" (mechanics of fluids); and "Units of Measurement," while there are additions to 13 other sections. Whether the inquirer is concerned with iron and steel manufacture or with the production and use of fuels, both solid and liquid, his general needs are well supplied by the numerous sections dealing with the various aspects of these subjects. Others, which may not appear to be directly applicable, nevertheless come well within the range of general knowledge that every engineer should possess, or at least have accessible for reference. To this end the comprehensive index of more than 16,000 entries will be appreciated by those who frequently have occasion to use it.

Very helpful, too, are the bibliographies of standard works attached to certain sections. The usual high degree of accuracy is well maintained and the type, if small in the interest of space conservation, is easily readable. The two volumes, with their flexible bindings and attractive red covers lettered in gold, neatly housed in a case for protection, make a handsome as well as a valuable addition to any engineer's library.

A PHOTOGRAPH in colour of a Morgan continuous merchant and rod mill is used to illustrate the 1961 calendar of the Indian Iron & Steel Company, Limited, Calcutta.

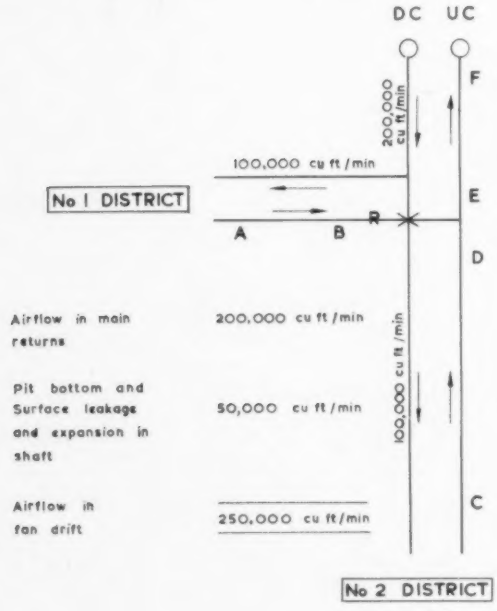
CORRESPONDENCE

MINE VENTILATION

To the Editor of IRON AND COAL

SIR,—I read with interest Mr. W. E. Vance's very useful paper entitled "Mine Ventilation," published in your issue of February 17. In one section of his paper, the author quotes Prof. Hinsley's formula for the most economic size of a mine airway and discusses the relationship between the cost of enlarging mine airways to various sizes and the value of the air horsepower saved by the enlargements. I feel, however, that the author has not sufficiently stressed the care which must be taken in applying the formula and the graphs he has derived from it, if quite misleading results are to be avoided. It is essential to remember that if Q in the formula is taken as the quantity of air flowing in the airway, the formula is valid only if *the whole of the airflow through the mine fan passes through the airway under construction.*

Let me take as an example a simple ventilation system, shown in the accompanying sketch, in which there are main airways leading to two districts—No. 1 district working an area of coal near the shafts, and No. 2 district working an area a long way from the shafts. Let me suppose that each district requires 100,000 cu. ft./min. of ventilating air, and that, because the resistance of No. 1 district is less than that of No. 2 district, No. 1 district requires to be regulated.



If the airway CD is enlarged so that the pressure loss between C and D is reduced from P_1 to P_2, then the mine fan handles the whole of its air at a pressure which is reduced by $P_1—P_2$. The air horsepower saved is therefore proportional to 250,000 ($P_1—P_2$) and not to 100,000 ($P_1—P_2$). Similarly, the air horsepower saved by enlarging the airway EF is proportional to the product of 250,000 (not 200,000) and the pressure is saved. On the other hand, if the airway AB is enlarged so as to reduce the pressure loss between A and B, no saving of air horsepower will result because the fan will have to continue to operate at the same pressure in order to ventilate No. 2 district, and the pressure saved will have to be absorbed by closing the regulator further. The most economic size of airway AB would be that which would enable the regulator to be dispensed with.

Hinsley's formula, giving a relationship between the economical cross-section and quantity flowing, would be more widely applicable if it were modified as follows:—

$$A^{\frac{7}{2}} = 66.6 \times 10^{-5} \times \frac{KQ_A^2 Q_F}{Zy}$$

where Q_A is the quantity of air flowing in the airway under consideration, Q_F is the airflow through the mine fan, A is the economical cross-sectional area in sq. ft., K is the friction factor, Z is the percentage annual charge per year, and y is the overall fan efficiency. This modified formula would still only be valid, however, provided that any change in the pressure absorbed by the airway would be reflected by a similar change in the fan pressure.

The problem becomes still more complicated when calculations are made of the most economic size of the airways in one split of a number of splits in parallel.

The views given above are my own, and are not necessarily those of the National Coal Board.—Yours faithfully,

JOHN G. BROMILOW,
Chief ventilation engineer.
National Coal Board,
Production and Reconstruction Department,
Hobart House,
Grosvenor Place,
London, S.W.1.
March 2, 1961.

A WIDE RANGE of products for use in industrial finishing processes will be shown by Johnson, Matthey & Company, Limited, at the first International Industrial Finishes Exhibition, at Earls Court, London, S.W.5 (May 8 to 11).

A COLOUR PHOTOGRAPH of the new 132-in. 4-high plate mill built for the Consett Iron Company, Limited, is used to illustrate the "at-a-glance" calendar of the International Construction Company, Limited, which commences with the month of March.

TEN YEARS' LARGE-SCALE *Vacuum Degassing of Steel*

by Dipl.-Ing. KARLHEINZ WERNER

The first part of this article was published in our last issue (p. 445). This report of the Iron Research Institute at Henningsdorf (director: Prof. Dr. Wolfgang Küntscher) is a comprehensive review of the theory and practice of vacuum degassing of steel. It is translated from Neue Hütte, 1960, V. No. 7, pp. 383-398. The second part of the article deals with installations for vacuum degassing, methods of operation of vacuum degassing plants, the action of vacuum degassing on impurities, properties and uses of degassed steel, and economics of vacuum degassing.

3—INSTALLATIONS FOR VACUUM DEGASSING

THE installations which are directly required for degassing, *i.e.*, the degassing vessels themselves, are as varied in their form as the methods employed, while the necessary auxiliary equipment, such as pumps, measuring instruments, coolers, etc., are approximately the same.

Vacuum Containers

Degassing in the Mould.—The simplest solution for vacuum degassing is presented by an apparatus which sits on the individual ingot moulds, and hence preference is given to the description of these devices. The Czech experimental plant of Z. Eminger and F. Kirsky already described serves for the stream degassing of steel during the teeming of 4.7-ton ingots.

Bottom plate, ingot mould, and top are in all instances provided with springs or keyways. In addition, the keyways are packed with asbestos string, which is dipped in a mixture of graphite and waterglass. The top is provided with a plate, in which are placed tubes for exhaustion, observation, and inlet of the steel. On this plate is the tundish. The sealing of the pouring aperture is effected with an aluminium plate.

Fig. 15, already referred to in section 2, shows the plant of the "Red October" Works in Stalingrad, described by Sokolov, Oiks, and Anshcheless[16] and Sokolov and Oiks.[24] It consists of a mould for 4.1-ton ingots with a closed bottom plate. Between the mould, 1, and the top, 2, is a seal, 5, which is not mentioned in greater detail. The top has a ring-shaped, machined flange, on which is placed a rubber ring. On to this rubber ring is placed in the lined tundish, 3, for 350 kg. of steel.

In the lower part of the tundish are the tube offtake for evacuation, an observation device and a box for anti-piping compound. For pouring a 30-mm. dia. magnesite nozzle is used. This is packed with a 1-mm. thick lead washer, smeared with a mixture of graphite and waterglass before teeming. Below the nozzle there is also a ceramic spout with an internal diameter of 80 mm., which is supposed to diminish the spread of the stream of steel.

The installation of the Phœnix-Rheinrohr A.G., represented in Fig. 16, has the disadvantage, as opposed to the system already mentioned, that a vacuum seal can only be obtained after the teeming ladle has been placed on the mould. Thereby evacuation of the space within of the mould is

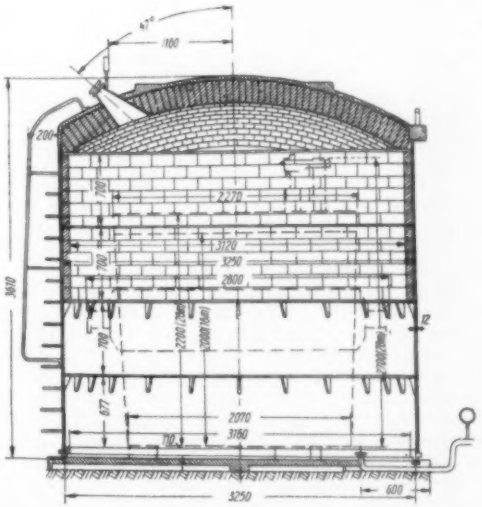


FIG. 18.—VACUUM CONTAINER FOR LADLE DEGASSING IN THE "SOVIET HAMMER AND SICKLE" WORKS[19].

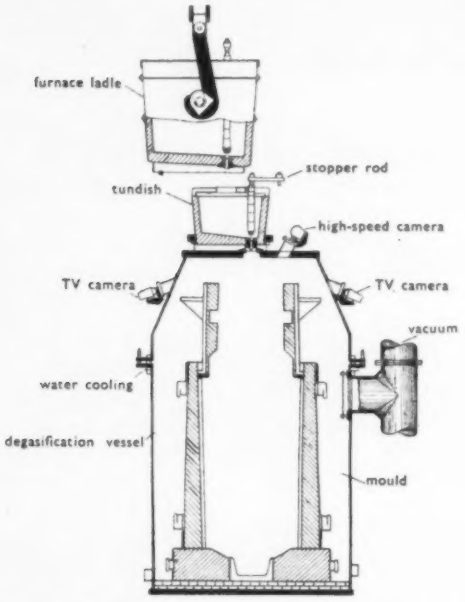


FIG. 19.—DIAGRAM OF THE VACUUM VESSEL OF THE 225-TON DEGASSING PLANT OF THE BETHLEHEM STEEL COMPANY[31].

delayed. Likewise, use is made of a big-end up, tapered mould, closed at the bottom, C, which sits on a sprung plate, G, and can thereby adjust itself to the position of the ladle placed upon it.

As already mentioned in the previous section, the ladle, A, is provided with a collar, B, in which is included the evacuation pipe, F. Between the collar and the mould is a seal, D, which is not described; this is compressed by the weight of the ladle.[43]

Degassing in the Ladle.—Fig. 18 shows a degassing chamber in the Soviet "Hammer and Sickle" Works (*cf.* also the Dneprospetsstal' Works plant in Fig. 6). This chamber serves for the degassing of steel in a 25-ton ladle, and consists of a welded, cylindrical vessel. stiffened with ribs, made from 12-mm. thick plate and having an external diameter of 3,250 mm. and an overall height of 3,610 mm. The roof is moved with a cable hoist.

In the up-to-date plants this is hung on hinges[24] (*cf.* Fig. 6). The inside wall has a chamotte brick lining 65 mm. thick. The roof is assembled like the roof of an electric-arc furnace. In the roof are the observation aperture and the evacuation nozzles. No mention is made of the sealing by Samarin *et al*[13]. It is to be assumed, however, that sealing is effected by means of rubber just as in both the plants at the Dneprospetsstal' Works.[44a]

Stream-degassing in the Ladle, and Vacuum Ingot Casting.—Since the vacuum vessels for stream degassing are used likewise for stream degassing in the ladle, as well as vacuum ingot casting, and

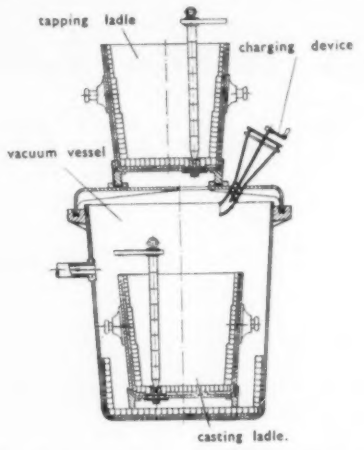


FIG. 20.—CHARGING DEVICE FOR ADDITIONS TO THE STREAM OF STEEL DURING STREAM DEGASSING[23].

do not therefore differ in their construction, they will be treated jointly.

In their shape these degassing vessels are similar to those used for degassing in the ladle already described. They do, however, differ from these in that they are built more strongly and carry a tundish on the roof with the corresponding sealing devices. They must be of strong construction, since on the roof of a 120-150-ton plant, for instance, there is an applied pressure of 230-250 Mkg., to which the external air pressure contributes about 120 Mkg.[20, 26]

The size of the degassing vessels is adjusted to the quantities of steel to be degassed. In Table 2 are compiled the dimensions of some of the known metal stream degassing plants. Their construction is similar to those shown in Figs. 8 and 10. Common to all the vessels is a solid construction of

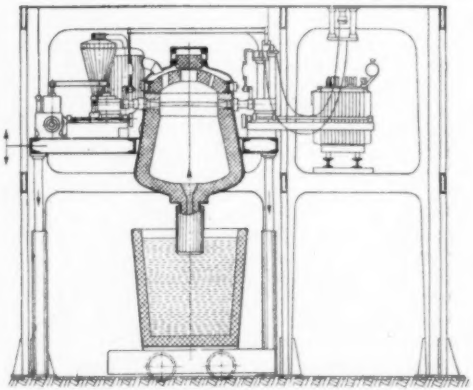


FIG. 21.—DIAGRAM OF THE VACUUM LIFT PLANT IN THE OPEN-HEARTH STEELWORKS OF THE DORTMUND-HORDER HÜTTENUNION AG[38].

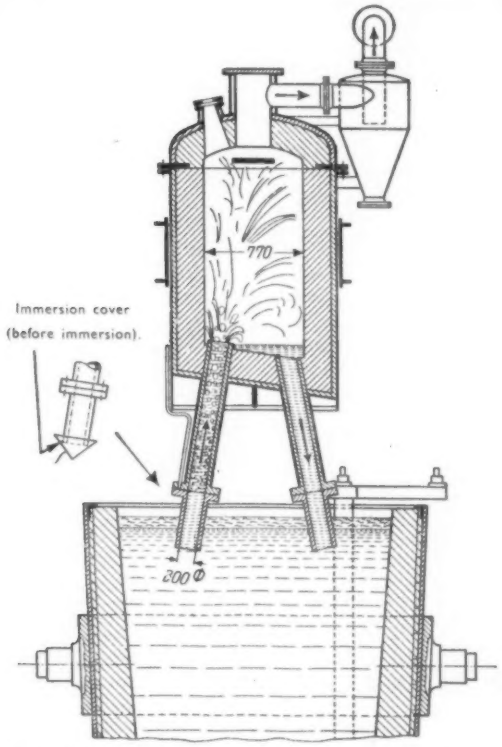


FIG. 22.—DIAGRAM OF THE CIRCULATION DEGASSING VESSEL OF THE RUHRSTAHL AG IN HATTINGEN[40].

the cylindrical bottom part of the vessel, and a massive roof construction, since the tundish is

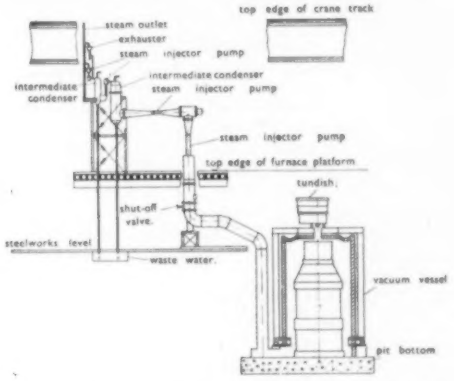


FIG. 23.—DIAGRAMMATIC PRESENTATION OF THE COMPLETE DEGASSING PLANT IN THE DUQUESNE WORKS OF THE UNITED STATES STEEL CORPORATION[39].

attached to the latter; in the plant at Sverdlovsk, for instance, the tundish has a capacity of 22 tons of steel[26].

Only the vessel of the United States Steel Corporation is more lightly equipped, since here the load of the full tundish and of the other necessary casting equipment is carried by a framework structure (*cf.* Fig. 23). Apart from this, the vessel is here shaped as a bell, so that the bearing flange is not at the top in the hottest zone, but at the level of the mould bottom plate. Cooling of this packing can therefore be dispensed with[30].

As a result of their height, degassing vessels must be installed in deep pits, which is a great disadvantage for works in areas where the ground water level is high. The vessels are completely[18, 26] or partly[22, 24] lined or, on the other hand, provided with water cooling.[2, 31–33] The bell-shaped vessel

TABLE 2.—*Main Dimensions of Certain Known Stream Degassing Vessels.*

Works.	Capacity, tons.	Diameter, mm.	Overall height, mm.	Plate thickness, Body, mm.	Plate thickness, Roof, mm.	Sealing between vessel and roof or cover and tundish.	Cooling.	Other remarks.	Literature source.
Seraing, Belgium	2 × 42 100	2,900 4,000	unknown	unknown	unknown	unknown	unknown	Ingot casting Ingot casting and stream Degassing in ladle	25
Bochumer Verein, Germany	2 × 35 150	2,400 (internal) 4,400 (internal)	4,200 9,000	unknown	unknown	unknown	unknown	Ingot casting and stream Degassing in ladle	20
"Red October," Stalingrad, USSR	20	3,300 (internal)	3,500	12	20	rubber ring 100 × 20 mm.	unknown	Stream Degassing in ladle	24
Urals Heavy Machinery Construction Works, USSR	30 120	4,900 (internal)	7,900	20	40	rubber 50 mm.	Seal with water	Ingot casting	26
US Steel Corp., USA	220	4,580 (internal)	9,450	unknown	unknown	Neopren O	—	Ingot casting	30
Bethlehem Steel Co., USA	7 2 × 225	2,750 4,650 (internal)	5,800 8,350	unknown 38	unknown 152	Neopren O Neopren O	unknown Seals and ingot casting vessel externally with water	Ingot casting and stream Degassing in ladle	32 2 31 32

TABLE 3.—*Vacuum Pumps so far Installed for Production-scale Vacuum Degassing Plants.*

Method.	Works.	Capacity of plant, tons steel.	Working pressure, torr.	Type of pumps.	No.	Capacity, m^3 per hr.	Switching.	Pressure stages, torr.	Steam Consumption pressure.		Literature source.
									kg. per hr.	Atm.	
Ladle degassing	"Red October," Stalingrad	20	5	Steam ejector RWN 60 Multiplate vacuum	2 2	Each 2,900	Optional parallel or in sequence	760 upwards 300 to 350 300 to 350 up to 5	300 to 600	5	24
Stream degassing	Seraing	100	4	2 series of piston Roots	1st stage 2nd and 3rd stage	As set 1,440 Nm^3/hr.	unknown	760 up to 300 300 up to 30 30 up to 4	—	—	25
	Bochumer Verein	150	1 to 10	Rotary piston	8	5,000	unknown	unknown	—	—	29
	Hoesch-Westfalenhutte AG		1 to 2	Steam ejector	Unknown	70,000	unknown	unknown	unknown	unknown	36
	Sverdlovsk	120	3 to 8	unknown	7	3,800	unknown	unknown	—	—	26
	US Steel Corporation	220	0.5	Steam ejector	4	170,000	In sequence	760 up to 127 127 up to 25 25 up to 20 20 up to 1	2,600	9.8	30 32
	Bethlehem Steel Comp.	225	1	Steam ejector	4	145 kg/hr. molecular weight 19.3	In sequence	unknown	4,400	10	2
Vacuum lift degassing	Dortmund-Horder Huttenunion AG	12	5	Roots rotary piston	1 3	6,000	unknown	unknown	—	—	9
Circulation degassing	Henrichshutte Hattingen	1	2	Water ring Roots	1 6 (1) (2) (3)	750 1,000 6,000 2,500	Parallel in sequence	760 up to 70 70 up to 50 50 up to 8 8 up to 2	—	—	40 41

of the United States Steel Corporation, due to the shape of its construction, requires neither to be lined nor cooled with water[30]. Within the roof construction of some plants are incorporated radiation protection plates.[24, 26, 30]

Apart from the aperature for the passage of the steel, which is sealed by means of aluminium, brass, or steel plates, in the roofs are incorporated apertures for visual, cinematograph, or television observation of the stream of steel and of the steel rising in the ladle or the mould (Fig. 19), as well as devices for the delivery of anti-piping compound or alloying and dexoidizing additions (Fig. 20). The nozzles for the suction pipes are for the most part installed in the vertical walls of the vessels.

As sealing material rubber or Neopren O is primarily used. The sealing channels are for the most part cooled with water, on the one hand, to protect the seal from the effect of heating, and on the other to prevent distortion of the machined sealing surfaces.

Vacuum Lift Process.—Fig. 21 shows a longitudinal cross section through the degassing equipment of the Dortmund-Hörder-Hüttenunion A.G., which is fixed to a stage which may be raised and lowered hydraulically; on the stage are the other auxiliary installations, also. The ladle is moved underneath the degassing equipment on a car. The vessel has an internal diameter of about 2,700 mm.[35], and is pear-shaped in construction. Its internal height is estimated to be 3,000 to 3,500 mm. On its underside it is provided with a suction nozzle, which is replaceable and is about 300 mm. wide internally.

The whole vessel and this suction nozzle are lined with a strong refractory material. For the roof, carbon bricks were chosen, because they make possible the use of supplementary heating due to their good temperature stability[9]. The lower part of the suction nozzle is also surrounded on its outer side by a refractory substance, since it is immersed in the liquid steel.

On account of the high temperature loss with this method supplementary, electrical heating is installed in the degassing vessel. The evacuation outlet is in the roof. In addition, devices for observation and delivery of additions are available.

Exact data concerning the sealing between the vessel and the roof, and between the vessel and the suction nozzle of the plant have not been published.

Circulation Degassing Process.—The circulation degassing vessel is shown in Fig. 22. It consists of a plate shell with an inclined bottom, into which the two circulation tubes are welded[40]. These have a replaceable ceramic tip, which is made vacuum tight with a flange. In order to prevent the passage of slag from the ladle into the vessel during immersion, the suction tubes are covered with steel

plate covers, which melt as soon as the suction tubes are immersed in the liquid steel.

The vacuum outlet tube and an observation aperture are in the roof of the plant and the suction tubes, vessels, and roof are lined with "suitable materials" which are not described in great detail. Below the vacuum suction nozzle there is also a ceramic baffle plate. The vessel with the lining has an internal diameter of 700 mm. and an internal height of 1,500 mm. The internal diameter of the suction pipes is 200 mm. Details concerning such features as the lining of the vessel and the cooling have not yet been published.

Vacuum Pumps

Apart from the various vacuum vessels the vacuum pumps are, in fact, the most important parts of every vacuum degassing plant. Their choice is naturally based on the required amount of degassing, and thereby on the size of the plant, as well as on the intended working pressure. In Table 3 are compiled some data concerning vacuum pumps already installed for production plants.

In Europe, mechanical pumps are predominant, while in the USA exclusively steam-ejector systems are employed. The latter afford the advantage of lower plant costs and less maintenance [2, 30–32, 44] Their disadvantage is the prerequisite of the availability of sufficient quantities of steam, and an exhaust pipe for it extended up to the roof (Fig. 23). Details concerning the construction of the pump system are provided by J. N. Hornak and M. A. Orehoski.[30] Sokolov and Oiks go into the design and possibility of switching of the pumps.[24]

Data concerning mechanical pumps are very scanty in publications.

Other Ancillaries and Instrumentation

Fig. 24 represents the layout of a degassing plant with mechanical and steam ejector pumps.[26] Since the mechanical pumps employed are very sensitive to dust and hot gases, it was necessary to install a cooler, 5, a cyclone, 1, and an oil filter, 2, between them and the degassing vessel, to cool and clean the waste gases.

In the Sverdlovsk plant, cleaning and cooling is carried out in a device consisting of a cylinder of 3,500 mm. by 600 mm. dia., in which tubes are placed in the longitudinal direction. Through these tubes, round which flows water, streams the gas sucked out of the degassing vessel.[26]

In plants which are equipped with Root's type pumps, gas cleaning can to a large extent be dispensed with, and only a cyclone employed for the removal of coarser dust particles of over 5μm[9]. Finally, cooling and gas cleaning can be completely dispensed with, if steam-ejector pumps are used, since they are exceptionally robust.

There are very few data concerning other parts of plants, such as vacuum pressure lines, valves, cooling systems, and so on. Only Sokolov and Oiks[24] report on the valves used in the "Red October" Works in Stalingrad. On the other hand, data concerning supplementary heating systems are more detailed. They are necessary above all with the partial quantity degassing methods, such as the vacuum lift and the circulation degassing methods. Thus H. Knüppel, K. Brotzmann, K. Rüttiger, and A. Diener[45] report on the heating of the vacuum lift device. By means of resistance heating (*cf.* Fig. 21) it is possible to reduce the temperature loss during degassing to about 30 deg. C. During the circulation degassing process, the transformer principle is employed for heating, whereby the primary coil is laid round the circulation tube, and the circulating steel represents the secondary.

4—METHOD OF OPERATION OF VACUUM DEGASSING PLANTS

In the method of operation of vacuum degassing plants there are two fundamental differences. During stream-degassing in the ladle and vacuum ingot casting, evacuation of the vessels can begin before the start of pouring. This has the advantage that possible residual humidity in the lining of the ladles or hot tops can still be removed, and no delays occur during pouring. By all other methods the ladle must first be conveyed into the degassing vessel or the degassing vessels must be immersed into the steel before evacuation can commence. During vacuum ingot casting there may be intensive boiling of the metal inside the hot top. In order to prevent it slopping over, as during ladle degassing, the pressure must be somewhat increased. Apart from this, the volume of the hot top must be increased, since the steel sinks far down into itself when boiling ceases with the breaking of the vacuum, so that a very large shrinkage cavity can be caused.

Where there is a multi-stage pumping system, the stage discharging into the outside atmosphere starts to operate first, and the subsequent stages are regularly switched in gradually after the required pressure is reached. When the vacuum is

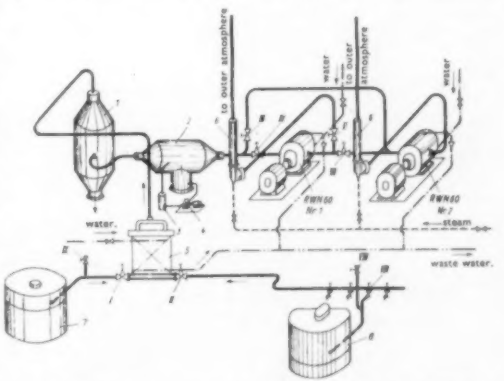


FIG. 24.—DIAGRAM OF THE VACUUM PLANT IN THE "RED OCTOBER" WORKS[24].

1.—Dust separator. 2.—Oil filter. 3.—Oil cleaner. 4.—Oil pump. 5.—Cooler. 6.—Steam jet injector. 7.—Ladle degassing vessel. 8.—Group casting stool degassing vessel. I to IX.—Vacuum valves.

being broken down, the reverse sequence is employed. To avoid explosions, it is recommended that an inert gas, such as nitrogen should be introduced before the degassing vessel is opened.[2, 30–32]

5—ACTION OF VACUUM DEGASSING ON STEEL IMPURITIES

The action of vacuum degassing on steel impurities is dependent on the working pressure, the area of the surface of the steel, and the time of degasification. It is therefore different for the individual degassing methods. In this section some information will be given on this subject, during which the sequence employed in section 1 will be preserved.

Gases Dissolved in the Liquid Steel

Hydrogen.—The producers of large forgings use vacuum degassing primarily for the removal of hydrogen, since thereby they can shorten the long heat treatments to remove flakes after forging and obtain a measure of certainty that the forgings are in fact free of flakes. In Table 4 are compiled the hydrogen contents attained with the various degassing processes.

Although these values are scarcely comparable, due to the different methods of taking samples and determination of the contents,[17, 38, 40] it may still be said that the lowest hydrogen contents are attainable by the vacuum ingot casting method, where once again a clear relationship to working pressure may be established. At any rate it has also been observed,[2, 8, 31, 32] that by reducing the pressure to less than 1 torr a substantial degassing effect is no longer achieved (Fig. 25, *cf.* also Fig. 1).

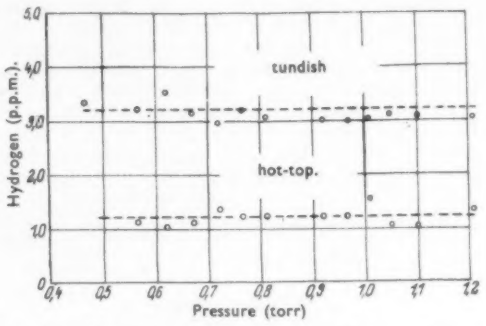


FIG. 25.—HYDROGEN CONTENT AFTER VACUUM INGOT CASTING IN RELATION TO CASTING PRESSURE[31].

Moreover, it has been established, [2, 23, 31, 32] that the hydrogen contents are not only low, but that the distribution of hydrogen is also homogeneous over the whole ingot.

Nitrogen.—In general, there is less interest in the removal of nitrogen than in that of hydrogen, since nitrogen is less harmful in killed and alloy steels. Data concerning the nitrogen contents achieved during vacuum degassing are therefore very scanty. With unalloyed and low-alloy steels it is possible to eliminate up to about 40 per cent. of the nitrogen.[13, 17, 44a] From mild, killed steels it has been possible to get rid of about 25 per cent., and from unkilled steels about 10 per cent. of the nitrogen.[23] With steels alloyed with Al and Cr this effect is likewise also only small,[30] and with austenitic steels scarcely any decrease in nitrogen was to be observed (Fig. 26).

TABLE 4.—*Hydrogen Contents Achieved by Vacuum Degassing.*

Method.	Works.	Working pressure, torr.	Treatment, Time, min.	Hydrogen contents, cm.³/100 g. Before.	After.	Hydrogen removed, per cent.	Method of determination of hydrogen.	Literature source.
Ladle degassing	Dzerzhinsk ..	5–10	12–15	~4.05	~1.95	52	unknown	14a
	Red October ..	15–25	5–7	Decrease of 0.3–2.0		unknown	unknown	16
	Mannesmann Duisburg-Huckingen	3–10	10	unknown 2–3		30 40	Degassing at 650 deg. C.	15
Stream degassing	Seraing	4	3–5	8	3	Up to 57	unknown	25
	Bochumer Verein ..	1–10	8	6	2	Up to 80	Tin melt method at 1,150 deg. C.	8 17 20 23
Vacuum ingot casting	Seraing	4	Up to 30	7	2	70	unknown	25
	Bochumer Verein	1–10	Up to 15	2.5–8.5	0.5–3.5	70	Tin melt method at 1,150 deg. C.	8 17 23
	US Steel Corp. ..	0.5	10–25	3.5–6.5	0.3–2.2	Up to 80	unknown	30 46
	Bethlehem Steel Comp.	0.5	17	3.7	1.5	63	unknown	2 31 32
Vacuum lift method	Dortmund-Horder Huttenunion AG	5–10	20	8	2.2	70	Vacuum melting method at 1,800 deg. C.	9 38
Circulation method	Ruhrstahl AG Hattingen	2	12–20	~7	~4	35–40	Tin melt method at 1,150 deg. C.	40

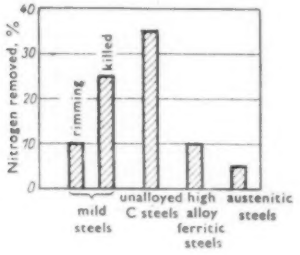


FIG. 26.—REMOVAL OF NITROGEN DURING STREAM VACUUM DEGASSING[23].

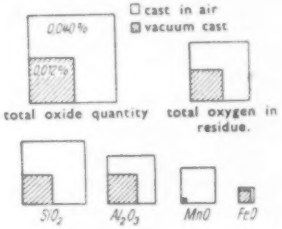


FIG. 28.—DIAGRAMMATIC PRESENTATION OF THE OXIDE CONTENTS OF STEEL AFTER AIR AND VACUUM CASTING.[5]

Gases Arising from Chemical Reactions in the Liquid Steel

A number of authors[8, 9, 13, 17, 23, 35, 36, 37] deal with the reduction of carbon monoxide. Producers of mild steels, such as deep-drawing and transformer steels, are particularly interested in this aspect. As has already been stated in the first part of this article, on the one hand a decrease in the carbon content and on the other hand a decrease in the oxygen content can be brought about. At extremely low pressure and with corresponding bath movement, the decrease in oxygen can be so extensive that no other deoxidation media are required[1].

Samarin and others[13] report, for example, on the degassing of transformer steel. Their results showed that in a number of melts the carbon contents were decreased to 0.02 per cent. and under, the sulphur contents to 0.003 to 0.005 per cent. (due to the ability to deal with hotter melts without the danger of "rising" ingots), and the oxygen contents to 0.004 to 0.005 per cent. In steels with higher carbon contents and in mild, rimming steels the oxygen content could, in fact, be reduced to 0.002 per cent. and under.[14a, 17, 23, 36] This means that through a reduction in pressure to about 5 torr the Vacher and Hamilton constant, which at atmospheric pressure is 0.0025, can be reduced by 10 per cent. (Fig. 27).

At the same time, however, the corresponding equilibrium value at this pressure is still not reached, apparently because oxygen is always again replenished from the lining or from the oxides present in the steel, and in the instance of ladle degassing or vacuum melting, the ferrostatic pressure on the bottom of the steel containers prevents the formation of bubbles. An approach to equilibrium, and this applies to hydrogen in the same way, is only possible, according to Ward[1], through the introduction of flushing gas.

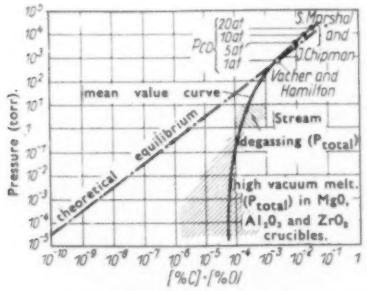


FIG. 27.—RELATIONSHIP BETWEEN THE PRODUCT OF PERCENTAGE CONTENTS OF CARBON AND OXYGEN AT ABOUT 1,600 DEG. C.[17].

Slag Inclusions

Since the oxygen content is decreased through vacuum degassing, the content of oxide inclusions in the steel is also diminished. Reports on this are given in a series of publications.[2, 3, 8, 10, 13, 14a, 17, 21, 25, 30-32, 34, 37-40, 47]

Regardless of the particular method of degassing, it is also established that above all the number of silicate and alumina inclusions is reduced (Fig. 28), and that the remaining inclusions are present in a fine and homogeneous distribution throughout the whole ingot. The absolute values for the content of oxide inclusions are at their lowest with the vacuum ingot casting method. A. Tix *et al*[23] have stated 40 g./ton.

As opposed to this by the vacuum lift method the figure was 100 to 200 g./ton, according to the position of the sample (top or bottom of ingot, *cf.* Fig. 29),[34, 38, 39] and by the circulation method 150 g./ton, and in favourable instances 30 g./ton.[40] Apparently, by the last named methods, however,

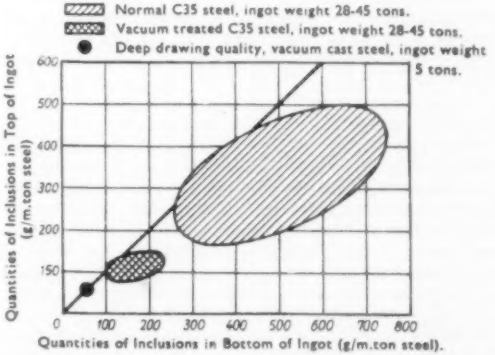

Normal C35 steel, ingot weight 28-45 tons.
Vacuum treated C35 steel, ingot weight 28-45 tons.
Deep drawing quality, vacuum cast steel, ingot weight 5 tons.
Quantities of Inclusions in Top of Ingot (g/m.ton steel)
Quantities of Inclusions in Bottom of Ingot (g/m.ton steel).

FIG. 29.—QUANTITIES OF INCLUSIONS IN NORMAL AND VACUUM CAST C35 STEEL AND IN VACUUM DEEP-DRAWING STEEL[39].

TABLE 5.—*Susceptibility to Flakes of Forging Pieces Quenched in Air.*[5]

No.[1]	Type of steel.	Casting method.	Ingot weight, tons.	Dimensions of piece quenched in air, mm.		Flakes found.
				Diameter.	Length.	
1*a*–5*a*	Ck. 45	Vacuum	21	450	1,000	None
1*b*–5*b*		Air				Yes
6*a*	Ck. 45	Vacuum	21	750	4,300	None
6*b*		Air				Yes
7	28 NiCrMo 74	Vacuum	100	450	1,300	None
8	28 NiCrMo 74	Vacuum	100	600	1,400	None
9	53MnSi 4+Cr	Air	80	450	1,500	Yes

[1] *a* and *b* are taken from the same melt.

the long time of contact with, and the erosive action of the circulating steel on the refractory linings of the vacuum plants exert an influence.

Other Elements which Contaminate the Liquid Steel

Concerning the removal of volatile elements from the steel only few data exist. Only Tix[8] states a percentage analysis of the filter dust, as it occurred in Bochum: 17.0 FeO, 47.0 MnO; 0.5 CaO, 1.1 SiO_2; 1.4 Zn; 2.6 Cu, 0.2 Sn and 1.0 Pb.

6—TECHNICAL PROPERTIES OF VACUUM DEGASSED STEEL

Through the extensive removal of the harmful accompanying elements in the steel some of the technical properties of the steel are favourably influenced. In this process the most important improvement is achieved through the reduction in the hydrogen content because the danger of flakes is eliminated thereby.

This is the main aim of producers of heavy forgings in the installation of vacuum degassing.[2, 8, 13, 17, 20, 23, 30-33] The hydrogen contents are so low, that forgings can be quenched in air without the occurrence of flake formation (Table 5). These observations of the Bochumer Verein are confirmed by the results obtained by the United States Steel Corporation and the Bethlehem Steel Company,[2, 31, 32] as well as in the experiments of Czechoslovak works.[3, 10, 11] The same thing is also true of rolled material.

An influence of degassing on the normal carbon, phosphorus, and sulphur segregations in larger ingots, which are dependent only on the solidification processes in large masses of steel, has not been observed.[2, 3, 8, 10, 11, 25, 31, 32]

The shadow bands are also still present, at all events without the cracks which very often lie between them.[17, 23] A direct action of degassing on the shadow bands was established only during experiments in Pilsen.[10] These showed that the zone of shadow bands was extended in the direction of the surface of the ingot and the individual bands were only incompletely formed; from this it may be concluded that the origin of the shadow bands is connected with the hydrogen content of the steel.

The segregation of rimming, mild steels is markedly influenced. Agreement is shown[13, 14*a*, 17, 23, 42, 44, 44*a*] in noting that segregations of the elements, carbon, phosphorus, and sulphur, is decreased, so that the segregation picture of degassed, rimming steel is similar to that of normal semi-killed steel.[17, 23] For example, G. Henke and W. Hess[44] have given values for the sulphur content in rimming steel at a level of 10 per cent. of the height of the ingot below its top:—

Melt analysis	0.022 per cent.
Air cast	0.185 ,,
Vacuum cast	0.090 ,,
Vacuum cast with the use of aluminium sealing membranes ..	0.028 ,,

The macrostructure of vacuum cast ingots is somewhat finer in the core and more homogeneously formed.[3, 10, 11, 13, 14*a*, 16, 25, 47] Likewise, the columnar crystals on the periphery of the ingot are supposed to be shorter.[3, 10, 11] It has not yet been possible to explain, however, whether this is brought about by the smaller gas content, which promotes supercooling capacity, or by the reduced temperature of the steel as a result of the splitting up of the stream of steel.[11]

Secondary pipe and porous areas in the ingot or casting are observed on a smaller scale than during normal casting in air.[3, 8, 14*a*, 16, 34, 38, 42, 47] Likewise, the tendency of the steel to conchoidal fracture formation which is attributed to hydrogen, is eliminated.[47*a*]

The surface nature of the ingots can, if the stream of steel is too strongly split up, be bad, since the steel splashes adhering to the mould wall are not melted.

The workability of vacuum treated steel is reported on by Harders *et al*[9] and C. H. Pottgiesser *et al*[39]. They established a stronger susceptibility of the unalloyed steels to overheating, which does not adversely affect the toughness, however.

Killed deep-drawing steels show a surface quality like normal, rimming steels, which is particularly suitable for the application of metal coatings. Thus, complicated components, which can be produced by deep drawing, can also be manufactured. The wear on the drawing tools is small. Also the machinability of degassed steels can be improved. During the scalping of bars of C35 steel, for instance, a 20 per cent. higher cutting rate was obtained with 20 per cent. greater working periods of the tools than with ordinary steels.

7—MECHANICAL PROPERTIES OF VACUUM DEGASSED STEELS

There is general agreement that vacuum degassed ingots show better tensile strength values, above all

in the transverse direction, and, what is more important, over the whole ingot at the same height.[2, 8, 10, 11, 23, 25, 30-33, 38, 48, 49]

The reasons for this are, firstly, the low hydrogen contents, which affect the fracture strength values, the fracture elongation and the reduction in area on fracture, on which special value is placed in the USA, in particular,[2, 30-33] and, secondly, the smaller contents of inclusions as well as the absence of cracks in the segregation zones, which increase the tensile strength values in the oblique direction. In this connection, nevertheless, the forgeability must also be considered[10].

Improvements in the elongation and reduction in area values in the transverse direction of up to 60 per cent. or over 100 per cent. (Fig. 30) have been attained.[2, 30-33] Likewise, the notch impact strength has been raised, especially on open-hearth steel[14a, 14b], while on all steels the transition temperature for the notch impact strength has been reduced by about 20 deg. C. Finally, it has been possible to lower the watt losses of transformer steels. Thus, for instance, in Zaporozhe[13] the proportion of material with less than 0.95 W/kg., was raised from 6 to 50 per cent.

8—APPLICATION OF VACUUM DEGASSING

In the last three sections the influence of vacuum degassing on the impurities in, and the resultant properties of, steels have been described. This points to the choice, and necessity for the application, of the method of degassing for definite purposes. In this connection a summary is presented in Table 6. It will be seen that in almost all

TABLE 6.—*Examples of the Use of Vacuum Degassing.*

Product.	Purpose of degassing.
Forgings	Freedom from flakes, better and more even toughness values; fewer slag inclusions.
Rolled material from types of steel susceptible to flakes	Freedom from flakes without heat treatment to prevent flakes
High purity steels, such as ball and roller bearing steels, aircraft materials, unalloyed tool steels, section steels	Fewer and finely distributed oxide inclusions
Transformer steel	Lower C, O, and S contents. Lower watt losses
Rimming steel for deep-drawing purposes	Little segregation, high output, good cold working properties, cleaner surfaces
Rimming, high-grade, free-cutting steel	Little segregation, good extrusion properties and good machinability
Open-hearth steel	Resistance to ageing
Steel castings	No porosity

spheres of steel production vacuum degassing is carried out. It has the greatest importance, however, for the production of heavy forgings, since here the losses through flakes or too extensive non-metallic impurities are most expensive.

For the choice of a definite process it may be said, in general, that the steel for large individual ingots or a small number of ingots from smaller charges is degassed by the ingot or group casting

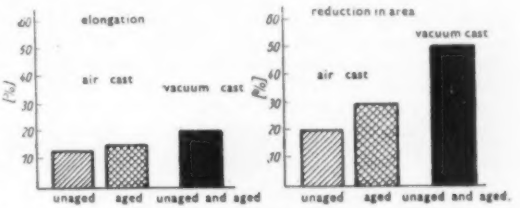


FIG. 30.—TOUGHNESS PROPERTIES IN THE TRANSVERSE DIRECTION OF FORGINGS FROM AIR AND VACUUM CAST NI-V-MO STEEL IN THE AGED (1 HR. AT 250 DEG. C.) AND UNAGED STATES[2].

methods, while the steel for numerous, predominately small ingots is degassed by the method of stream-degassing in the ladle.

If there is some objection to the construction of the deep pits necessary for this purpose, then it is necessary to pass to one of the partial quantity degassing methods. These latter have the disadvantage, however, that the steel comes into contact with the refractory linings of the degassing plants for a longer time and wear on the linings is inevitable. Apart from this, supplementary heating devices are required.

The working pressure should be about 1 torr. Higher vacuum pressures exert no substantially greater influence on the gas content of the steel. If there is sufficient steam available to fulfil this requirement preference is to be given to a system of steam-ejector pumps, since the plant and maintenance costs are lower than with mechanical pumps.

9—ECONOMIC CONSIDERATIONS

Precise data concerning the economic aspect of vacuum degassing are not available. It is established, however, that degassing plants are very expensive, and the major part of the plant costs falls on the pump systems. This makes itself apparent above all when mechanical pumps are employed. Added to these high plant costs are the production and maintenance costs. For instance, the preparation of the mould for a large forging ingot in a vacuum vessel takes longer than normally and requires a greater labour force also. The special refractory materials for the roofs of the degassing vessels are likewise very expensive.[2, 31]

Mechanical pumps demand special maintenance and, in certain instances, supplementary heating systems are necessary. Opposed to these costs is the gain in the improvement of the quality of the products, which is expressed in a decrease in the proportion of scrap and an increase in the output, as well as in a shortening of the time of heat treatment to remove flakes from heavy forging pieces. F. Harders[34] therefore comes to the conclusion that it is economic for the forge shop to pay an additional price for every ton of vacuum degassed steel; this price amounts to five times the maximum costs of vacuum treatment.

In addition, the consistency of the properties of the steel offers consumers increased security

which can by no means be assessed in figures, but which on its own already justifies the higher price of vacuum degassed steels. According to the data of K. C. Taylor[50], the higher price amounts to between $6 and $9/ton, where the vacuum ingot casting plant is in daily use.

SUMMARY

Already in the nineteenth century the first patents were granted for the vacuum degassing of liquid metals. The development of pumps of sufficiently high capacity, however, did not permit vacuum degassing on a technically and economically representative basis until after the second world war.

A description has been given of the methods and the necessary installation for the degassing of large quantities of steel. These are: ladle degassing with or without flushing gas, stream degassing of molten metal in the ladle, vacuum ingot casting, the vacuum lift method, circulation degassing and ingot degassing.

According to the degree of vacuum attained, it is possible to reduce the contents of hydrogen, nitrogen, oxygen, and other harmful elements, whereby the mechanical properties of the steel—above all the toughness and long-term tensile strength—are improved. Apart from this the danger of flakes is eliminated, and thereby the scrap is reduced.

The concomitant higher production costs are justified by this improvement in quality, so that today in all important steel-producing countries vacuum degasification is employed, primarily for the production of large forgings for power plant construction.

NOTE.—The complete list of references was published at the end of the first instalment of the article in last week's issue.

FILM REVIEW

"Fashioned in Steel"

MAIN products of Darlington Forge, Limited, a wholly-owned subsidiary of the English Steel Corporation, Limited, Sheffield, are featured in an instructive and interesting new film "Fashioned in Steel." The film is quite comprehendable to the layman and of especial value to those who are entering the metallurgical and engineering industries. It is a 16-mm. colour film of 38 min. duration and has an excellent commentary.

A brief historical sequence shows the original forge on the Ordnance Survey Map of 1855 and then proceeds to illustrate the close association of the company with the shipbuilding industry of the Tyne, the Wear, and the Tees, with reference to the fact that extensions to the plant at the turn of the century included the building of furnaces, a heavy foundry, and a 3,000-ton forging press.

After being acquired by the English Steel Corporation, Limited, in 1930, Darlington Forge continued its policy of specialization in "tailor-made" components, such as castings and forgings of unusual and intricate nature, and examples of these appear in the film. One such example—a complicated cast-steel sternframe for a 65,000-ton tanker—shows the sternframe being assembled into the tanker, followed by explanations with the use of a model. All the various stages of manufacture are shown, starting with the wooden pattern, the moulding and core-making processes, the pouring of the steel, the fettling operation, and, finally, the machining of the finished casting.

Returning to the model, the film then explains that certain components, the backpost and the rudder stock, are subjected to very great stresses and, consequently, demand the improved physical characteristics which are obtained by forging. This leads to a sequence showing the forging of a rudder stock, the use is made of animated diagrams to explain the more difficult parts of this forging sequence. Cast and forged shaft brackets for multiple-screw ships are introduced in the next sequence and shots of the more spectacular aspects of the intricate forging operations are shown. Propeller shafts and parts for Doxford oil engines are also included among the shots of forgings for shipbuilding.

Moving to the heavy engineering projects, the film shows forged steel rings, over 8 ft. in dia. for reinforcing the duct openings in reactor pressure vessels for nuclear power stations. Components for the iron and steel industry are represented by cast-steel bells and hoppers for blast furnaces, cast and forged steel rolls for hot-rolling mills, and composite back-up rolls used in the cold rolling of sheet steel.

The closing shots show some impressive examples of heavy plant in which Darlington Forge castings and forgings are used—a blast furnace, hot and cold continuous reduction mills, an extrusion press, and a bending press. The film, a production of the ESC Film Unit, ends with shots of the launching of the Canadian Pacific Empress of Canada at the Walker Yard, Newcastle-upon-Tyne, of Vickers Armstrongs, Limited.

USSR Plans 180-ton Electric Furnace

Capable of producing over 250,000 tons of high-quality steel a year, a 180-ton electric furnace is to be built in the USSR, and put in service some time before the end of 1965. Extensively mechanized and automated, it will be a three-phase, three-electrode furnace, consuming up to 45,000 kV/amps., and will have a capacity greater than a 400-ton open-hearth furnace.

COAL PLOUGHING IN THE WEST MIDLANDS

Forum on Operational Experience

Experience with coal ploughs was discussed at a meeting of the South Staffordshire, Warwickshire, Worcestershire, and Shropshire Branch of the National Association of Colliery Managers on December 8, 1960. The discussion, in the form of an open forum, was preceded by three short papers by Mr. H. Wright, manager, Cannock Wood Colliery, Mr. A. E. Darlow, manager, Newdigate Colliery, and Mr. T. Crellin, manager, West Cannock No. 5 Colliery, all in the West Midlands Division of the National Coal Board. The papers are given below.

AT CANNOCK WOOD COLLIERY

By H. WRIGHT

PRIOR to plough installations at Cannock Wood Colliery, Hednesford (Staffs), mechanization had included the Anderton disc shearer and the Meco-Moore cutter loader. With the increased need for both mechanization and large-coal tonnage, the first Anbauhobel was installed in the Bass Seam during September, 1958, and two subsequent installations in the seam have been successfully worked.

The Bass Seam lies at a depth of approximately 750 ft., the seam section varying from 5 ft. thick with a shale roof to 7 ft. thick, which includes 2 ft. of "rider" or roof coal. In both conditions the working height of the seam is 5 ft. An interesting feature of this seam is the relative strengths of the seam and floor, the seam having an impact strength index of 68 and the floor 35.

Ploughs were installed at three faces, 6s, 16s, and 7s, in the Bass Seam, and of these, 6s and 7s are currently in production. The face length of 6s Bass face, which is a single unit, is 125 yd., including right- and left-hand stables of 9 yd. and 7 yd., respectively. The cleat in relation to the face line is "face on" or "bord" and support throughout the face is by hydraulic props and 8-ft. long, 3½-in. by 3½-in. steel joists set in pairs at 4-ft. intervals. Steel-base chocks, 3 ft. by 2 ft. by 2 ft., reinforce the breaking-off line of the wastes, the chocks being spaced at 4-ft. centres. The waste is totally caved and gate-side packs are 3 yd. long adjacent to the ribside (in each case) and 5 yd. adjacent to the goaf.

The plough comprises a standard Anbauhobel unit having separate drives for the conveyor and plough. The plough and the conveyor are each driven by two 45-h.p. motors. The plough unit can be built up by additional sections and in each case is 1 ft. 9 in. high with additional knife sections on the cutting head to pre-cut approximately 2 in. Hydraulic pushers, operating at a pressure of approximately 450 lb./sq. in., are installed at 15-ft. intervals along the conveyor length.

Electrical Equipment

Conditions of service of the electrical equipment for any plough installation must be that the cutting head can be readily moved in either forward or reverse directions and where two-motor drive is used, pick-up time between motors must be as low as possible.

The electrical equipment for the plough at 6s Bass face originally consisted of four contactor panels of 80-amp. rating, two being sited in the main-gate roadway and two in the tail-gate roadway. Both pairs of panels are fed from two 200-kVA transformers.

The contactors represent forward Nos. 1 and 2 panels and reverse Nos. 1 and 2 panels. Sequence cables along the face ensure that forward No. 1 panel closes in the main gate and then pulls in forward No. 2 panel in the tail gate, and conversely for the reverse panels.

A signalling system which enables the plough to be stopped and started is used. The signals have twin-push signalling boxes spaced at 31-ft. intervals along the face length, one button being for signalling and the other for locking-out the complete electrical apparatus.

To complete the mechanized face installation, an armoured conveyor with one or two motor drives, depending on face length, is used. The signalling system for the armoured conveyors is common with that used for the plough equipment.

A point to note is that contactor panels for

plough installations are now being used at Cannock Wood Colliery which contain the forward and reverse contacts in one panel.

Ploughing Experience

As the face started from the ribside, roof pressure was insufficient to have any effect on the coal until an advance of approximately 60 yd. had been made. During this advance the coal was very hard and the advance was limited to approximately 2½ ft. per day. The daily number of shear pins used was about 38, partly due, no doubt, to the inexperience of the operators. Moreover, no contract was set during the preliminary period.

After the first major roof movement, ploughability of the seam improved and at this time a contract was set. Table 1 shows the effect on output. o.m.s., and cost per ton as the face advanced from the ribside.

TABLE 1.—*Effect of Output, Productivity, and Cost per Ton as Ploughability Improved with Increasing Roof Movement at 6s Bass Face, Cannock Wood Colliery.*

Month (1958).	Output, tons.	O.M.S., cwt.	Wages cost, per ton. s. d.
September ..	2,016	50.2	24 5
October ..	2,537	65.1	22 4
November ..	4,242	84.8	17 5
December ..	5,352	112.5	12 10

Successful ploughing operations continued at 6s Bass face until the unit began to pass over old pillars, 80 yd. wide in the Deep Seam 149 ft. below. Roof conditions deteriorated and it was decided to put in two intermediate packs in the middle of the face. This had the effect of steadying the roof and also helped to avoid prop losses. After the face has passed inside the roof breaks from the pillar edge, roof conditions improved and, consequently, hardening of the coal was experienced.

Deep-hole infusion was tried in an attempt to improve ploughability and 25-ft. deep holes were bored into the coal spaced at intervals of approximately 50 ft. The flowing pressure was 500 lb./sq. in., and the infusion rate 2½ gal./min., approximately 60 gal. of water being pumped into each hole. Infusion was found to improve ploughability, but not to the extent that was expected. After passing over the pillar normal ploughing conditions returned.

Results from 6s Bass Seam face are shown in Table 2. The first two quarters of 1960 were effected by a large upthrow fault stopping the face for a period.

TABLE 2.—*Results from 6s Bass Seam Face at Cannock Wood Colliery.*

Quarter ended.	Saleable output, tons.	O.M.S., cwt.	Wages cost, per ton. s. d.
September, 1959 ..	11,014	120.5	12 2
December, 1959 ..	16,166	145.4	10 7.3
September, 1960 ..	10,977	117.8	12 5

Repairs and renewals for a six-month period for this face amounted to 9.3d. per ton, the largest item being shear pins at £267. Hard coal, compared with the rest of the face, has always been present for a distance of approximately 20 yd. from each ribside.

Due to the length of the face being 125 yd. and a coal rib being present at both ends of the face, results from this face have not been outstanding. However, wages cost per ton is better by approximately 7s. when compared with orthodox hand-filled faces.

16s Bass Face

The 16s Bass face is a single unit 180 yd. long, including two stables 11 yd. and 7 yd. long. The cleat in relation to the face line is "end on." This face was in the same area as 6s face, both having a working height of 5 ft. and a fairly strong shale roof. Face support was identical with that of 6s face, and since no experience of ploughing an "end on" face was available, it was decided to work 16s face on a trial basis.

Again difficulty was encountered in moving from a coal rib. It was thought that the extra face length would help the coal to "work," but after 100 yd. of face advance had been completed, ploughability had not improved in spite of water infusion.

After some consideration it was decided to install a pre-cutter to pre-cut to a depth of 2 ft. 9 in. at about 1 ft. from roof level. This 12 in. of coal readily parted from the shale roof and the 8-ft. bars were moved forward over the fallen tops to support the exposed roof. Ploughability improved, no overhanging tops having to be fired as was found necessary prior to pre-cutting. A longer jib was successfully tried giving an effective cut of 4 ft. Table 3 shows the results before and after pre-cutting 16s Bass face.

TABLE 3.—*Results at 16s Bass Face, Cannock Wood Colliery. Before and After Pre-cutting was Applied to a Ploughed Face.*

Quarter ended.	Output, tons.	O.M.S., cwt.	Wages cost, per ton. s. d.
Solid Ploughing February, 1960 ..	11,109	82.2	17 3
Pre-cutting May, 1960 ..	18,652	114.2	13 0.1

Pre-cutting did not cause any deterioration in roof conditions, but it did limit the output of the face. This face was stopped after a predetermined distance had been advanced, the conclusion having been drawn that all plough faces should be "face on" or "bord."

7s Bass Face

The total length of 7s Bass face is 150 yd., which includes two stable holes 11 yd. and 7 yd. The cleat in relation to the face line is "face" or "on bord" and the seam height is 7 ft. with a working thickness of 5 ft., giving a coal roof of

2 ft. Between the working thickness and the coal roof there is approximately 4 in. of dirt which causes the coal to part readily from the roof coal, giving good ploughing conditions. The face equipment and the roof support system are identical with 6s Bass face.

Prior to the plough installation, the face was an orthodox hand-filled face, machine cut, working on a 48-hr. cycle. Production had been consistent, but operational costs and productivity were not up to present standards. Because of the need for improved efficiency and increased large coal output, it was decided to install a plough identical with previous ones. Since this was a production face the changeover from hand-filling to mechanized mining was effected during the week ended October 8, 1960. Considerable help was given by the Area mechanization engineer and the mechanization team. All the equipment was placed in the respective roadways adjacent to the face and as much work as possible, both electrically and mechanically, was done prior to the weekend. Most of the hydraulic props, 8-ft. steel joists, and steel chocks were got on to the face and set during the fortnight before the changeover.

Installation shifts during the weekend amounted to 102½ shifts at a cost of £417. A contract was quickly agreed and Table 4 shows the results before and after the changeover.

TABLE 4.—*Operational Results at 7s Bass Face with a Coal Plough Compared with Hand-filling.*

Quarter ended.	Output, tons.	Saleable O.M.S., cwt.	Wages cost, per ton. s. d.
Hand-filling			
13-week period, June, 1960	11,354	77.8	19 10.7
Ploughing			
Four weeks ended October 19, 1960	6,066	131.9	11 8.1

Large-coal proportion from the plough face is 53 per cent. of plus 1½-in. and from an orthodox hand-filled face in the same seam 43 per cent.

Conclusions

(1) Cleat is all important for successful ploughing.

(2) When starting a plough face from a coal rib consideration should be given to moving away by hand-filling methods up to a distance of 60 yd., or to pre-cutting for the same distance to improve ploughability.

(3) Water infusion can improve ploughability where hard coal persists.

(4) A plough installation can be carried out at a weekend on an orthodox hand-filled face without any loss of output.

(5) Fairly soft floors can be dealt with by varying the pressure applied to the conveyor rams. High pressures tend to lift the ploughing horizon.

(6) Face line is all important and should be perfectly straight for the main part of the face; to avoid the plough chain swinging across the conveyor, the drives should be kept approximately 6 in. in front of the face line.

AT NEWDIGATE COLLIERY

By A. E. DARLOW

NEWDIGATE COLLIERY, near Nuneaton, works the Warwickshire thick coal, and before considering the problems associated with ploughing the middle part of this seam, an explanation of the method of working is needed.

The Warwickshire thick coal varies in thickness between 18 ft. and 22 ft., and is made up of five separate seams, of which the Top Seam has been extracted. The Top Seam, which is the highest quality coal, was worked by a conventional method for many years under private enterprise, and the rest of the thick coal was left. This was done to avoid the fire hazards which were associated with methods of total extraction as practised at Coventry Colliery and Exhall Colliery.

Fortunately, the coal immediately underlying the Top Seam, or Two Yard, is of very inferior quality, and the rule was that this must not contaminate the output, otherwise the proceeds would be seriously affected. The major part of the Two Yard has been worked out, leaving the remaining four seams to be worked. To do this, the middle seam, the Ryder, is advanced as a single-unit face using the Bare Coal as a roof. Roadways are formed by floor ripping the Ell Coal and Nine Feet Seam and, when an arbitrary boundary has been reached, the Nine Feet Seam is retreated using the same roadways. The Ryder Seam is of a fairly soft nature, well fractured, parting easily from the Bare Coal roof and from the Ell Coal floor. It is therefore an extremely easy ploughing proposition.

The problems associated with ploughing are ones of strata control, and they are problems which existed when working the seam conventionally. Many times it is necessary to cross under old roadways in the Two Yard workings, and it has been found that the majority of the old arches were not drawn off. Consequently, the road was allowed to close up by sides and roof falling between the arches and the floor lifting. This caused extremely weak Bare Coal, and while the face was working on a conventional method it was very difficult to support the roof in these disturbed regions. At least once a week a fall, of varying proportions, would occur in this area, often stopping production for 48 hr. Extra support was introduced in the form of chocks and girders straddling the conveyor. As a further precaution, the area was worked entirely by hand-got methods.

When the plough was installed, arrangements were made to provide extra support in the area of old roadways by additional chocks immediately behind the armoured conveyor, and long girders between the link-bar system. The old roadway under which the face was travelling when the plough was installed had given considerable trouble, but within a fortnight of the plough starting it was difficult to see the old road. This has since been

explained by the fact that the plough action is more gentle on the roof than a coal cutter. The only difficulty still associated with old roads is that the coal on each side and under the old road becomes very hard and sticky, and has to be brought down by shotfiring.

Working Under Old Goaf

The second problem associated with conventional working was the dealing with areas where the Bare Coal had been worked. Although it was forbidden to work the Bare Coal, there were exceptions to this rule, particularly where the working height of the Two Yard Seam was less than 4 ft. 6 in. Where the Bare Coal has been taken there are two courses of action open.

The first is to set supports up to the old goaf. This, surprisingly enough, is practicable if the old goaf is slightly moist and has consolidated to some extent, and providing a considerable amount of wooden supports had been left in.

The second alternative is to attempt to split the Ryder Seam and leave some Ryder up for a roof and to regain working height by taking some of the Ell Coal. This has been done successfully in areas where the Two Yard goaf is dry, but it is a hazardous operation. In fact, both alternatives are hazardous when working a conventional system.

From the plans of the Two Yard workings it was not anticipated that the plough face in the West District would encounter any area where the Bare Coal had been worked. However, four weeks after the plough started, evidence of what was thought to be a floor roll came in at the left-hand gate, and further exposure of this seemed to indicate that the Nine Feet Seam was partially cut out. The measures, in general, had all been pushed up, with the result that the Two Yard was missing. Consequently, the Two Yard face which had worked this area had not only robbed the Bare Coal but had also taken some of the Ryder.

Further exposure showed that Ryder Coal had been pinched out. Two courses were open. The first was to abandon the face, head past the disturbance, reopen the face, and transfer the plough machinery forward. The second was to continue working under old goaf mining whatever coal could be found. This would mean having to by-pass the disturbed area when the Nine Feet Face was retreated.

Despite the disturbance, 3 ft. of advance per day was still being obtained and it was decided to carry on working the face and to prove the full area of disturbed ground. The face was kept level, and did, in fact, cross from one seam to another and back again. At the right-hand end of the face conditions were normal, the plough then passing into Ell Coal at the point of the Ryder pinch out, then carrying on along the face working Ell Coal and Bare Coal supporting the old goaf, and finally working Ell Coal and part of the Nine Feet using some Bare Coal as roof. The face advanced some 80 yd. before it was completely free from disturbing ground.

It is notable that during that time of passing through the disturbed ground, there was not a single fall on the face, and the average advance of 3 ft. per day was maintained. It is quite true to say that had the plough machinery not been on the face, the face could not have been worked through this area by conventional methods.

It has always been considered that the working of the Two Yard Seam had completely de-stressed the seams below it, and these stresses had not built up again even after nearly 30 years. The operation of the plough has proved this not to be so, because if it were not for some stress in the strata, the Ryder coal would not plough, as is borne out by the way in which coal does not "work" in the areas of old Two Yard roadways. It must be concluded that high-speed ploughing is an effective method of extracting the Ryder Seam, particularly under very adverse conditions.

AT WEST CANNOCK NO. 5 COLLIERY

By T. Crellin

WHEN the possibilities of ploughing at West Cannock No. 5 Colliery, Cannock Chase Area, were first discussed in 1957 an installation in the New Mine Seam was considered, but after visits of specialists it was decided that this was not a practical proposition due to a very thick dirt band and a weak floor.

The only other likely possibility was a panel of coal in the Deep Seam, which was known to be almost free of faults. The seam is 49 in. thick with a strong fireclay floor and a strong grey mudstone roof. The coal is very hard with an apparent lack of definite cleavage. Then the same specialists visited the colliery again and formed the opinion that this was also not a ploughing proposition due to the hardness. However, as a face was already developed it was decided to install an Anbauhobel rapid plough. This face was 186 yd. long and was pre-cut to a depth of 1½ m. and ½ m. above floor level. An Armstrong Airbreaker was used to break down the coal and roof control established with 6-yd. packs and 6-yd. wastes with three chocks in each waste. Hydraulic props with link bars were used to support the roof and compressed-air pushers or rams were used with a pressure of 60 lb./sq. in. to force the plough and conveyor into the face.

When the face first began production roof conditions were very good, but within two weeks there was 3 to 4 ft. of following stone coming with the coal and extensive breaks in the roof were apparent.

During the ensuing weeks it was obvious that something must be done. Therefore, the compressed-air pushers were exchanged for Gullick hydraulic pushers, chiefly because the small compressor used was inadequate. After much experimenting, 280 lb./sq. in. was found to be the most suitable pressure. At the same time it was decided to try total caving with chocks at 4-ft. centres as the men were not able to keep up with the packing due to the prevailing conditions; this was quite

an innovation as the seam had never been totally caved before. We also altered the system of supports and used rigid steel joists 8 ft. long and 3½-in. by 3½-in. section.

Immediately these changes were made, experiments to plough solid coal were made during the weekends. Some officials gave their own time in these trials until one morning it was decided not to pre-cut for the following morning. This was an immediate success and within four days face conditions were improved, the roof was caught and the coal worked freely. Convergence which had been about 4 in. every 24 hr. was now less than 1 in. in the same period. Face output per man-shift rose from 3 tons to 7 tons and the number of men was reduced to 12.

The success of the coal plough was due to the following factors: —

(1) The hydraulic pushers with the proper pressure forced the plough into the coal.

(2) Rigid steel joists gave improved support as they did not sag.

(3) Total caving provided the necessary roof control to enable enough pressure to be exerted on the coal face, thereby assisting to prepare the coal for ploughing.

(4) By stopping pre-cutting the induced roof breaks were much less frequent and certainly less severe.

As this face was nearing exhaustion another one was prepared on the left side, but a fault limited the face length to 110 yd. long compared with 186 yd. on the previous face.

Additional Labour Needed

The intention was to extend the face as it advanced and to do this special Support Rules were made. As the length of the stable increased, towards the end of each week an extra coal filler had to be employed. Each Saturday the panzer drive and plough were extended along with the various attachments. More labour was also required on ripping.

This operation was successfully completed and the face is now 210 yd. long and is yielding a face o.m.s. of 10 tons with a weekly output of 2,000 tons.

In recent months a plough has been installed in the Shallow Seam. The gradient of the face is 1 in 1.4 for the first 50 yd. and 1 in 1.7 for the next 98 yd., making a total face length of 148 yd. The height of coal worked is 6 ft.

After much discussion at the colliery it was decided that the only way to work this face successfully at this gradient was by ploughing.

The same system of support for total caving was again tried and again the results were phenomenal as the Shallow Seam had never been totally caved before and it was thought to be impossible. Roof control is very good and no undue roof pressures have been experienced. As a ploughing proposition it was an immediate success.

The main effort is concentrated on moving the chocks and supports forward, this taking at least 75 per cent. of the available time. Difficutly with inadequate hydraulic pressure on the pusher was overcome by transferring the pump to the bottom end of the face and it was found that the pushers required 350 lb./sq. in. to be successful. To maintain this pressure at the top end of the face 500 lb./sq. in. had to be applied at the bottom half. This meant an excessive use of shearing pins. Starting up the plough without the ram pressure was tried, the pump being started when the plough was travelling. Although this was partially successful, a revised hydraulic system proved to be the final solution to the problem.

Special arrangements have been made for anchoring the drive at the top of the face, limiting the downhill creep to about 1 ft. 6 in. each week. On this face a 10-ft. fault is present, but it can be negotiated without too much trouble.

All ploughing is done with the minimum of manpower on the face and the plough is stopped while the chocks and supports are moved over.

No claims to great success is made on this face, but it is thought that ploughing is the best system in the circumstances. At present the face yields 900 tons weekly, with an o.m.s./faceworker of 6 tons.

BTR at the BTF

CONVEYOR belting for underground and surface application, industrial hose for all purposes, V-belts, p.v.c. pipes and fittings, mouldings and extrusions in natural and synthetic rubber and ebonite, and rubber footwear will be among the exhibits of BTR Industries, Limited, London, S.W.1, at the British Trade Fair in Moscow.

The BTR group is the largest supplier of p.v.c. fire-resistant anti-static conveyor belting to the National Coal Board and has supplied the Polish State Mines with large quantities of specially designed belting of this kind. BTR rubber belting is widely used in the gas, electrical, and steel industries, in ore mining, quarrying, sand and gravel handling, and many other industrial processes. A substantial quantity of specially designed belting—some of it up to 80 in. wide—has been supplied to Russia for ore carrying.

New Chock for Thin Seams

IN describing the new friction chock, manufactured by Hugh Wood & Company, Limited, Gateshead-on-Tyne 11, in our February 24 issue, reference was inadvertently made relating the marking of the horizontal setting wedges with the pre-setting load.

The marking ensures an approximate load capacity of 35 tons and not a pre-setting load of 6 tons as stated.

AN AGREEMENT concluded in Sofia between Bulgaria and North Korea specifies that North Korea shall supply Bulgaria with special steel and super-hard alloy during 1961.

Forthcoming Events

MARCH 13

Institution of Mechanical Engineers:—Meeting organized by the Industrial Administration and Engineering Production Group at 1, Birdcage Walk, London, S.W.1, at 10 a.m. Informal discussion on "Human Capabilities and Limitations in Industrial Operations." Registration forms from the secretary of the institution.

Lincolnshire Iron and Steel Institute:—Meeting at the North Lindsey Technical College, Kingsway, Scunthorpe, at 7 p.m. Annual general meeting followed by young members' papers.

Institute of Marine Engineers (West of England Section):—Meeting at Smith's Assembly Rooms, Bath, at 7.30 p.m. "General Developments in Ceramics for Marine Engineering," by F. J. Aldred and N. W. Hinchcliffe.

MARCH 14

Institution of Engineers and Shipbuilders in Scotland:—Meeting at 39, Elmbank Crescent, Glasgow, C.2, at 6.30 p.m. "The Helicopter and its Place in the Transport Field," by E. Mensforth.

Institution of Production Engineers (Luton Section):—Meeting at Luton College of Technology, Park Square, Luton, at 7.30 p.m. "Dynamic Testing of Machine Tools," by Prof. S. A. Tobias.

Institution of Mechanical Engineers (Midland Branch):—Meeting at Rugby College of Technology at 6.30 p.m. "The Design and Development of Machine Tools," by C. A. Sparkes.

Institute of Marine Engineers:—Meeting at the Memorial Building, 76, Mark Lane, London, E.C.3, at 5.30 p.m. "Materials for Advanced Steam Conditions and Their Influence on Operation of Turbines and Boilers," by Cdr. H. E. C. Hims and S. H. Frederick.

MARCH 15

Midland Counties Institution of Engineers:—Meeting at the University, University Park, Nottingham, at 3 p.m. "Mine Ventilation Planning," by P. L. Collinson and W. A. Vance.

Mining Institute of Scotland:—Meeting at the Mining Laboratories, 79, Grassmarket, Edinburgh. "Subsidence—the Transference of Ground Movement to Surface Structures," by F. P. Gardner and Prof. G. Hibberd.

Institution of Plant Engineers (Kent Branch):—Meeting at the King's Head Hotel, High Street, Rochester, at 7 p.m. "The Use of Light in Industry," by A. E. Fothergill.

Institution of Production Engineers (Birmingham Section):—Annual general meeting at the Midland Hotel, Birmingham, at 6.30 p.m., followed, at 7 p.m., by "Town Planning and Materials Handling, with Special Reference to Birmingham, in the 1970s," presented by the Birmingham Section of the Materials Handling Group of the institution.

Institution of Electrical Engineers (Rugby Sub-centre):—Meeting at Rugby College of Engineering Technology, at 6.30 p.m. "The Determination of the Electrical Characteristics of an Arc Furnace," by J. Ravenscroft.

Junior Institution of Engineers (Sheffield and District Section):—Meeting at the Royal Victoria Hotel, Sheffield, at 7.30 p.m. "The Development Engineer in the Petroleum Industry," by E. S. Sellers, president of the institution.

MARCH 16

Society of Instrument Technology (East Midland Section):—Meeting at Derby and District College of Technology, Kedleston Road, Derby, at 7.15 p.m. "Recent Developments in Industrial Electronics," by E. Metcalf.

Society of Instrument Technology (Newcastle-upon-Tyne Section):—Meeting at Roadway House, Oxford Street, Newcastle-upon-Tyne 1, at 7 p.m. "The Rotameter Sheds its Limitations," by H. Williamson.

South Wales Institute of Engineers:—Meeting at Park Place, Cardiff, at 6 p.m. "Recent Developments in the Production of Steel Castings in Engineering," by D. H. Snelson.

Institution of Mechanical Engineers:—Meeting at the Royal College of Science and Technology, Glasgow, at 7.30 p.m. "Design of Modern Boilerfeed Pumps," by H. H. Anderson.

Institution of Mechanical Engineers (East Midlands Branch):—Meeting at the Technical College, Scunthorpe, at 7.30 p.m. "Cost Reduction in Heavy Engineering," by J. E. Chadbund.

Institution of Mechanical Engineers (Southern Branch):—Meeting at the King and Queen Hotel, Brighton, at 7.30 p.m. "Planned Maintenance," by W. Jones.

Combustion Engineering Association (Western Region):—Meeting at the Seabank Hotel, Portheawl (Glam), at 10 a.m. "Instrumentation of the Boilerhouse," by J. D. Rutherford.

Institute of Marine Engineers (West Midlands Section):—Meeting at the Engineering Centre, Stephenson Place, Birmingham, at 7 p.m. "Heat Exchangers—Design Aspects to Avoid Corrosion," by G. Page.

Junior Institution of Engineers (North Western Section):—Meeting at the Engineers' Club, 17, Albert Square, Manchester 2, at 7 p.m. "The Development Engineer in the Petroleum Industry," by E. S. Sellers, president of the institution.

MARCH 17

North East Coast Institution of Engineers and Shipbuilders:—Meeting at the Mining Institute, Newcastle-upon-Tyne, at 6.15 p.m. "Experiments on Compression of Double-bottom Plating," by T. Jaroszynski.

Institution of Plant Engineers (Birmingham Branch):—Annual general meeting at the Imperial Hotel, Temple Street, Birmingham, at 7.30 p.m., followed by a film entitled "Economic Boiler Plant," introduced by K. J. Luntley.

Junior Institution of Engineers:—Meeting at Pepys House, 14, Rochester Row, London, S.W.1, at 7 p.m. "The Use of Oxygen in Steelmaking," by J. L. Harrison.

MARCH 20

Institution of Production Engineers (Leeds Section):—Meeting at the Hotel Metropole, King Street, Leeds 1, at 7.30 p.m. "Work Study," by G. A. Daniell, preceded by the annual general meeting at 7 p.m.

Institution of Production Engineers (Newcastle-upon-Tyne Section):—Annual general meeting at Gateshead Technical College, Durham Road, Gateshead 9, at 6.45 p.m., followed by the chairman's address at 7 p.m. and a tour of the college workshops and laboratories.

MARCH 21-25

Electrical Engineers (ASEE) Exhibition:—Earls Court, London, S.W.5, 10 a.m. to 7 p.m. (March 22, 10 a.m. to 9 p.m.).

National Association of Colliery Managers

MARCH 14

Yorkshire Branch:—Meeting at the Miners' Welfare Hall, Brodsworth, at 3 p.m. Film show.

MARCH 17

North of England Branch:—Annual informal dinner (men only) at the Old Assembly Rooms, Newcastle-upon-Tyne 1.

MARCH 20

Midland Branch:—Meeting at the Denman's Head Hotel, Sutton-in-Ashfield, at 6.30 p.m. Paper by W. E. Vance, ventilation engineer, No. 3 Area.

MARCH 22

Lancashire Branch:—Meeting at 40, Portland Street, Manchester. Discussion on "Methods of Roof Support in View of Impending New Regulations."

North of England Branch:—Meeting at the Mining Institute, Newcastle upon Tyne, at 6.45 p.m. "A Study of the Converter-driven Four-rope Friction Winders at the Theresa and Castlereagh Shafts, Dawdon Colliery," by D. L. Hunt.

MARCH 24

Yorkshire Branch:—Dinner and dance at the Danum Hotel, Doncaster.

Graham Clark Lecture

The Graham Clark Lecture, delivered annually on a topic of common interest to the Institution of Civil Engineers, the Institution of Mechanical Engineers, and the Institution of Electrical Engineers, will, this year, be delivered by the Duke of Edinburgh. His subject will be "Resources, Human and Material, of the Commonwealth." The lecture will be given at the Institution of Civil Engineers, Great George Street, London, S.W.1, at 5.30 p.m. on April 13. Admission will be by ticket and will be limited to members of the three institutions. The lecture is named after the late E. Graham Clark, who was secretary of the Institution of Civil Engineers from 1937 to 1954.

This paper, from which extracts have been taken, was the first of two lectures being given on the steel industry, and was presented at a meeting of the Royal Society of Arts in London on Wednesday. The author is chairman and managing director of Colvilles, Limited, Glasgow. Mr. G. C. H. Chubb, managing director of Chubb & Sons Lock & Safe Company, Limited, London, W.1, was in the chair at the meeting. The second lecture will be given on March 22 by Sir Robert Shone, executive member of the Iron and Steel Board, who will speak on "Economic and Commercial Aspects of the Steel Industry." The chair on that occasion will be taken by the Paymaster General, Lord Mills.

The Steel Industry Today and Tomorrow

A Technical Review by Sir Andrew McCance, FRS

IN 1960 Britain's steel production was 24,200,000 tons. If we accept that the age of steel manufacture, as it is known today, began in 1864 with the successful industrial application of the inventions of Bessemer and Siemens, then it took Britain 51 years to reach its first 8,000,000 tons of annual steel output. The second 8,000,000 tons was reached in a further 35 years, but the last 8,000,000 tons to bring the total to the output of today has taken only 10 years. From esimates of the immediate future development made after a careful study of known commitments and present trends, the next 8,000,000 tons, it is estimated, will become a reality in only six years' time.

It is the intention of this paper to review briefly some of those technical advances which have contributed to this rapid growth and to indicate also the direction from which future technological improvements can be expected to come. This will be done under three main sections—pig-iron manufacture, steelmaking, and rolling-mill techniques.

Blast Furnaces

Since 1950 the production of pig-iron in the United Kingdom has increased by 48 per cent., but the number of blast furnaces in operation has gone down by 22, so that the average output per furnace has increased by 76 per cent. The size of a furnace is rated by its hearth diameter and, while there are still a few with a hearth diameter of less than 12 ft., their number is rapidly diminishing as they are no longer economic to operate. At the other end of the scale, as the hearth diameter is increased there is a limit set by a technical restriction, namely, there comes a stage at which sufficient air is unable to reach the coke at the centre of the hearth and the rate at which coke can be efficiently burnt and consumed has reached its limit.

While a blast furnace produces pig-iron, it does so through its ability to burn coke. Restrict this and the production of pig-iron is automatically reduced. So, at the present time the growth in hearth size is temporarily halted at a limit of about 32 ft. However, other ways and means to improve outputs have been found.

By increasing the total pressure inside the furnace, the density of the air can be made greater and a better degree of penetration obtained. So—what is called the high top-pressure furnace was introduced. If air is blown into the furnace at a pressure of 20 lb./sq. in. and passes out at atmosphere pressure at the top, by using a large-scale safety valve at the top the discharge pressure can be raised to 10 lb. and the blowing pressure increased to 30 lb. This system has proved quite successful and a large number of high top-pressure furnaces are now in operation. By this device the output of a furnace can be improved by about 10 to 15 per cent., which is quite an important gain. This increase is obtained without any material change in the coke consumption per ton of iron.

By screening out all the fines before charging the ore, a freer passage is offered to the reducing gases and this practice was becoming common during the period prior to the war. The fines were treated separately by sintering—that is, they were mixed with fine coke breeze spread on a travelling

table and by burning the coke were joined together or "sintered" into larger lumps which were then recharged into the furnace. Using beyond 30 to 35 per cent. sinter, the operation of the furnace tended to become irregular, and as the proportion of fines in both home and imported ores was in excess of this percentage and was tending to become even greater, the fullest advantage of sintering could not be achieved.

Scientific investigation into why this should be so showed that in the process of sintering some of the iron oxide in the ore combined with the silica to form iron silicates which were not amenable to gaseous reduction and could only be reduced by coke in the lower and hotter parts of the furnace. It was in Sweden that the practice was first developed of adding limestone to the sinter mixture prior to sintering and this practice has spread rapidly everywhere and is now extensively used in Britain. By combining with the silica to form calcium silicates which are the main slag-forming constituents, the iron oxide is left free so that lime serves a double purpose.

The use of conditioned sinter—the name now given to sinter with lime additions—has led to spectacular improvements in blast-furnace performance and economy. A burden consisting wholly of sinter is now possible. Furnaces of the largest size which in the pre-sinter period gave 1,500 tons per day can now produce over 2,000 tons per day and the advent of the 3,000-ton per day furnace is in sight. An increase of 10 cwt. of sinter per ton of iron has reduced the coke rate by 4.3 cwt. If a burden of 100 per cent. conditioned sinter were used a further saving of 3.5 to 4.5 cwt. could possibly be realized.

The urge to explore the use of other fuels in the blast furnace is very strong, and is undoubtedly the direction for one line of future research.

Steelmaking

In steelmaking, the trend in the construction of furnaces to build them of larger and larger capacities has gone hand in hand with the construction of larger blast furnaces. There is this difference, however. Steel-melting shops are designed for the capacity of the furnaces they have to house. It is not a simple matter to alter the size of melting furnaces appreciably once they have been constructed, but when new melting shops require to be built, the furnaces installed are always larger than the old ones. Thus, the number of open-hearth furnaces of 200/250-ton capacity has increased greatly during the past 10 years.

Prior to the war, most open-hearth furnaces in Britain operated with producer gas made from coal, but since the war there has been a substantial swing over to the use of fuel oil, including tar and creosote/pitch mixtures. The annual consumption has risen from 788,000 tons in 1950 to 2,408,000 tons in 1960. This substitution of fuels has been due mainly to the better outputs obtainable with oil fuel. Increases of 40 to 50 per cent. in production are being realized with marked benefit to the costs, and it seems inevitable that this trend in the use of fuel oil will continue.

The more intense flame temperatures with oil have a rather severe effect on the furnace refractories, and changes in furnace design have been necessary. Interest in the use of basic bricks has been stimulated and, although the first trials were not altogether successful, good results are now being obtained provided that a basic-lined furnace once lit it not allowed to cool down but is run continuously throughout its campaign. Close temperature control must also be maintained during the course of the charge. Under such conditions good outputs and low refractory consumption can be obtained, but the economic gain is marginal.

By far the most outstanding change now in progress in the steelmaking world is the growing use of oxygen and the resuscitation of the Bessemer process which its use has brought about. There grew up in the minds of users two designations for steel—Siemens or open-hearth steel, and Bessemer steel, according to the method used in its making. Experience over many years showed that Bessemer steel, particularly basic-Bessemer steel, was not so consistently reliable as open-hearth steel, being much more prone to develop a condition of brittleness. For long the cause of this condition was a mystery, but it is now known to be associated with the nitrogen content, the difference in the physical properties of steel arising from an increase from 0.005 to 0.010 per cent. nitrogen being quite marked.

Continued efforts were made to rid the process of its disadvantage, and some success was achieved, but the methods required to make low nitrogen steel were not easy to control and were never widely applied. After the conclusion of the war, developments in the use of oxygen took place rapidly for three main reasons: the improvements in the technique of oxygen liquefaction making the production of large tonnages commercially possible, the increase in the demand for deep-drawing sheets and flat-rolled products for which a steel with a low nitrogen content was necessary, and the need to increase the production rate of steelmaking to maintain economic solvency in the face of increasing wages and other costs.

First came the use of enriched air in the ordinary Bessemer converter, the normal oxygen content of 21 per cent. being increased to 30 or 35 per cent. The use of 100 per cent. oxygen in the converter presented great difficulties. The heat was so intense that the refractories suffered much damage. Then the use of diluents other than air were tried to exclude nitrogen from the process altogether, and for this purpose carbon dioxide and steam were both economically available. Oxygen-steam mixtures in a 60/40 ratio are now being used successfully and they offer advantages where a Bessemer steel plant already exists as well as being economically attractive owing to the great speed of production which can be achieved. The actual blowing period for a 60-ton charge is about 10 min.

The difficulties in regard to the tuyeres and the

refractories arising from bottom blowing with oxygen led metallurgists to consider doing away with bottom blowing altogether and blowing oxygen from a tuyere at the top of a converter on to the surface of the liquid pig-iron held in a solid-bottom vessel. The first trials on a small scale were carried out at the Linz and Donawitz works in Austria and proved rapidly successful. The installation of a vessel holding 30 tons quickly followed, and it proved commercially successful almost at once. A 65-ton installation at the Jones & Laughlin works in Pittsburg has produced upwards of 750,000 tons in one year, although in this case an average weight of about 80 tons was being charged. In a new installation under construction by the same company, 200-ton vessels are to be employed and a similar size of vessel is to be employed at the plant of the Broken Hill Proprietary Company in Australia.

Both in Austria and America the rapid development of the LD process, as it is named, has been favoured by good quality pig-iron containing only 0.10/0.25 per cent. of phosphorus. With higher phosphorus contents of over 1 per cent. in the pig-iron the mere bulk of the slag present causes difficulties and it is necessary to carry out reduction in two stages—removing the first slag and reforming for the finishing stage. To help in overcoming this problem, experiments carried out in Belgium and France introduced powdered lime into the vessel with the oxygen blast. Charges have been made on a semi-commercial scale in Belgium, and now on a commercial scale at Dillingen, making steel without slag removal from pig-iron with a 1.8 per cent. phosphorus.

Two other methods of applying oxygen, making use of rotating vessels, are also making headway—a Swedish process—the Kaldo—and a German process—the Rotor. The growth in the production of oxygen blown steel has been rapid, and the world production is now running at about 8,000,000 tons per annum, with new plants projected or under construction which will bring the total capacity to about 15,000,000 tons per annum.

One interesting development has been the extension of continuous casting in steelmaking. The difficulties of applying this process to steel are now being gradually overcome largely through the development work on the process carried out by the British Iron and Steel Research Association. Several large plants are projected and should be in operation within the next two years making slabs for use in the strip mills. Russia has independently encouraged the construction of steelworks using continuous casting on a large scale, and several are now in operation. Where large outputs are required, however, it is difficult to see how continuous casting can compete with traditional methods.

Rolling Mills

There have been no really major developments in rolling-mill techniques in recent years. The growth of production has meant a growth in size, in power, and in the speed of rolling and an increase in the number of stands that go to make up a complete mill.

In rolling steel the first operation on the steel ingot takes place in the cogging mill, which breaks down the mass of 10 to 20 tons of metal to a smaller cross-section and cuts it into sizes of lesser weight suitable for the finishing mills which roll it to the saleable product. Generally, the whole output of the works passes through one cogging mill so that large outputs are handled. The upper limit for a straight cogging mill is about 1,500,000 tons per annum. If larger outputs have to be dealt with, the next stage converts the normal cogging mill to a universal mill in which powerful vertical rolls act in conjunction with the horizontal rolls, and the production can then be doubled to about 3,000,000 tons per annum.

Naturally, the construction of such mills is very massive. The total weight of machinery and racks for a complete installation would be about 6,000 tons, while the mill would be driven by twin motors of 12,000/14,000 h.p., with a further horsepower in ancillary equipment of about 7,000/8,000. With such large figures, it can be understood why the construction of a new steelworks is an expensive affair. At today's level of costs, an integral plant including coke ovens, blast furnaces, melting shop, and rolling mills for a production of 1,000,000 ingot tons per annum would involve capital expenditure of about £100,000,000.

In the operation of rolling, the final dimension of the product is approached in stages by adjusting the height of the rolls. This height is controlled by the mill operator and with more rapid operation recourse to automatic control is taking place to a steadily increasing extent. In the first stage push-button control brings the rolls automatically to the correct adjustment. The second stage of automation—sequence control—carries through such adjustments in the correct order to correspond to whatever rolling schedule has been previously agreed. The completely automatic mill, in which every operation is carried out without the intervention of a mill operator, is fast approaching.

Gas Journal Directory

The Gas Journal Directory, 1961, recently published, includes, among other information relating to the nationalized gas industry, the following:—United Kingdom gas statistics; personnel of the Ministry of Power, including Gas and Electricity Divisions; personnel of the Gas Council with its various departments; Area Boards; oversea undertakings; gas associations in UK; national organizations and those of a kindred nature, including the British Coking Industry Association; British Road Tar Association; British Sulphate of Ammonia Federation, Limited; Coke Oven Managers' Association; Low Temperature Coal Distillers' Association; National Benzol and Allied Products Association, and the Association of Tar Distillers. Other features include technical articles on various aspects of gas making and distribution. The directory is published by Walter King, Limited, 11, Bolt Court, Fleet Street, London, E.C.4 (price 30s., post free).

FILM REVIEW

"Report on Sixties"

MADE by the National Coal Board's Technical Film Unit, "Report on Sixties" demonstrates the practical duties of a deputy making a pre-shift examination prior to the preparation of his pre-shift report. Emphasis is placed on the importance of the constant vigilance needed for the detection of methane both in the general body of the ventilating current and in the formation of roof layers by reference to the lessons learned by a young deputy during his training period when he was accompanying an experienced official.

During the film, which has a running time of 36 min., the viewer is taken on a tour of the deputy's district. While examining the mechanized face a minor fall occurs and the correct method of dealing with this incident is illustrated by the action of the deputy, who ensures that steps are taken to make the fall area safe before continuing on his inspection.

Some of the other points which receive attention in the film include the examination of belt conveyors for accumulations of dust and jamming of the idlers by trapped coal and dirt, the importance of haulage safety appliances, and the inspection of first-aid equipment. Although this film is primarily intended for the training of deputies, it gives a very good general picture of work in a district during the coal producing shift.

Some of the other films produced by the NCB's Technical Film Unit include an 8-min. technical exposition of the Mawco cutter loader, designed to win larger coal than the Anderton shearer, and a film entitled "New Power in Their Hands," which dramatises the revolution in coal-face work over the last 12 years. Designed for general showing and with a running time of 20 min., the film has been selected, along with one other film, as the official UK entry for the 1961 Eurovision Grand Prix for television films. The competition, which will take place during the Cannes International Film Festival in May, is staged by the European Broadcasting Union in order to encourage the production of good films for television.

The NCB's public relations branch has recently published an up-to-date catalogue of films dealing with many aspects of mining. It contains not only details of films produced by the NCB, but also information on "Mining Review," produced monthly by Data Film Productions, Limited, and films on coal by other sponsors. The films produced by the NCB can be obtained on free loan from the Film Library, National Coal Board, Hobart House, Grosvenor Place, London, S.W.1.

A BELGIAN REPORT states that crude steel production in Czechoslovakia increased by 10.3 per cent. in 1960 to 6,786,000 tons, while pig-iron output increased by 10.6 per cent. to 4,695,000 tons.

Russians to See British Mining Equipment

PRODUCTS of Dowty Mining Equipment, Limited, Ashchurch, Tewkesbury (Glos), are to be displayed at the forthcoming British Trade Fair in Moscow as a further step to an active sales campaign recently carried out in East European countries. Three major products manufactured by Dowty Mining will be seen on the stand of the company's agents, Joberg, Limited. They are the Dowty Roofmaster, the Dowty Duke hydraulic pitprop, and the Dowty 50-ton hydraulic chock. All these products are hydraulic roof supports for use in coal mines. It is expected that Russian mining technicians will show great interest in these items.

The Dowty Roofmaster is a self-advancing system of roof support which is powered hydraulically and keeps pace with the latest types of coal-cutting machinery. A complete coal-face installation can be handled by only two men and the Roofmaster ensures greater productivity in fully mechanized mines. The Dowty Duke is a "yielding" hydraulic pitprop which allows for roof convergence while maintaining adequate support, while the Dowty hydraulic chock is a robust, easily-set roof support for the waste edge. All Dowty roof-support equipment can be recovered without danger to the operator and is designed to have a long and trouble-free life.

The British Trade Fair in Moscow opens on May 19 and will continue until June 4. It is being sponsored by British & Industrial Trade Fairs, Limited, in conjunction with the Association of British Chambers of Commerce.

TURNER & NEWALL PRODUCTS IN MOSCOW

FOUR companies of the Turner & Newall, Limited, organization will be exhibiting at the British Trade Fair in Moscow. They are: Turner Bros. Asbestos Company, Limited, Rochdale; J. W. Roberts, Limited, Bolton; Washington Chemical Company, Limited, Washington (Co. Durham), and Ferodo, Limited, Chapel-en-le-Frith.

The Turner Bros. Asbestos display will focus attention on the wide range of asbestos textile products, jointings, conveyor, elevator, and power transmission beltings as well as plastics reinforcement materials produced by the company. Ferodo exhibits will demonstrate the range of the company's interest in friction materials. These include brake and clutch linings for every type of vehicle as well as for earth-moving machinery, colliery winders, and every type of industrial application where moving machinery must be brought to a stop.

PROVISIONAL FIGURES issued by the Venezuelan Ministry for Mines and Petroleum indicate that iron-ore exports in 1960 totalled 19,600,000 tons, an increase of 2,650,000 tons on the previous year.

Indian Branch, NACM, Annual Meeting

RETIRING PRESIDENT'S COMMENTS

IN his presidential address at the annual general meeting of the Indian Branch of the National Association of Colliery Managers, held on January 14, Mr. A. Wright said the association in India had not been very active during the last few months. The most regrettable feature, he said, was the lack of response by members in producing technical papers. Mr. Wright, who is deputy chief mining engineer of the East India Coal Company, Limited, is succeeded as president by Mr. J. S. Grewal, general manager, Raneegunj Coal Association, Limited, Kustore Colliery.

At a council meeting following the annual meeting, Mr. H. G. Stephenson was appointed hon. secretary and treasurer of the branch. He succeeds Mr. J. S. Jootla, who, in presenting the council's annual report for 1959-60, said that 10 meetings were held during the year; the average attendance was only seven, whereas the full council numbered 18. The seventh session of the industrial committee on coal mining was attended by Mr. Wright as an observer. The branch's demand for full representation on the same basis as the Government, owners, and labour was opposed.

When, in his presidential address, Mr. Wright reviewed the mining industry in India, he said it was pleasing to note the general increase in coal production during the year, but the rate of increase was far too slow to achieve the targets of the Five-Year Plan. To achieve these targets the price of coal should be increased immediately by Rs. 2 or 3 per ton. This would increase the profit margin and give the private sector of the industry the best possible incentive to increase output. It would also enable the various reasonable demands of the employees to be met without financially crippling the companies concerned. At the same time, the price of Indian coal would still be competitive with other fuels.

Transport Problems

Everyone who spoke on the subject of the coal industry complained about transport. To improve the efficiency of the industry, there must be a large increase in planned expenditure. In particular, the number of wagons must be increased, so that wagons were standing in the colliery yards waiting for coal. If this resulted in a slightly less efficient railway system and wagon utilization, the Government must face this for the benefit of all industries which used coal. Road construction and road haulage should also be freed of all restrictions.

Mr. Wright said that money should be spent in contracting out the major reconstruction work of the industry. If the National Coal Development Corporation was prepared to do this, through German, American, British, or Russian engineering contracting firms, they would certainly pay more, but they would get first-class mines designed by experts and handed over for production at a much earlier date. This had been proved by the nationalized steel plants, which were completed on schedule and were now part of a modern industry. It was much more difficult to develop a mine than to take control of an operational mine and, while there was no shortage of mining engineers, the industry was very short of mechanical and electrical engineers and, in particular, the skilled tradesmen, fitters, electricians, erectors, etc., for equipping complete new mines.

A further hindrance to production was the increasing number of checking, regulatory, and supervising officials from numerous Government departments. "The amount of time spent by managers in dealing with these officials considerably reduces the effective time for management control," said Mr. Wright. It was time the Government laid more emphasis on production and less on other aspects of the industry.

A completely new approach was needed by various departments so that the trend of thinking was to aim at a higher production rather than to hamper it. What was required was positive assistance to the industry and not negative actions like pegging production.

Similarly, in view of the rapid expansion of the industry, and the ever-increasing need for suitable trained junior staff, it would be a step forward if the Mines Department could depute junior officials for two days per week to hold classes for shotfirers, "mining sardars," and overmen. This would give a trained supply of personnel to the industry who would be both safety conscious as well as production conscious and would help to meet the acute shortage of qualified personnel. If all concerned with the mining industry in India approached the problem of attaining planned targets with a positive outlook, the Third Five-Year Plan could be achieved.

IWM's Internal Conference

Chairman at one of the sessions of the first international conference of the Institution of Works Managers will be Sir Andrew McCance, FRS, chairman and managing director of Colvilles, Limited, Glasgow. The conference will be held at Bournemouth from April 21 to 23. Details may be obtained from the institution's general secretary, Mr. George J. West, at 196, Shaftesbury Avenue, London, W.C.2.

Steel Developments in Turkey

AS a result of the expansion of the Karabük steelworks and plans for a second integrated plant at Eregli, Turkish steel capacity of about 300,000 tons a year should be more than trebled in the next five years. A British Iron and Steel Federation Intelligence Report on the subject states that domestic raw materials resources have hitherto been adequate to cover the requirements of the Turkish iron and steel industry. Hard coal is mined in the Zonguldak region near the Black Sea coast, and present annual production is about 6,500,000 to 7,000,000 tons. There are numerous iron-ore deposits, but the main mines are at Divrigi, which supply the Karabük works. Coal mining is entirely in the hands of the State, while iron ore is mined by both the State and private firms. Iron-ore production in recent years has averaged about 1,000,000 tons annually, roughly a third of which has been for export.

The State-controlled Karabük works (100 miles north of Ankara), which started production in 1939, now comprises:—Four batteries of 21 coke ovens each; ore-crushing, screening, and sinter plants; 2 by 500-ton blast furnaces with hearth diameters of 4.6 m.; a 500-ton mixer, 2 by 65-ton and 2 by 150-ton basic open-hearth furnaces; a blooming/slabbing mill, three section mills, and a medium plate and sheet mill; and a cast-iron pipe foundry. Current developments include three further batteries of 21 coke ovens, extension of the sinter plant, a third blast furnace with a daily capacity of 900 tons, two more 150-ton open hearths, and a new continuous bar, rod, and strip mill. When these developments are completed by the end of this year, annual capacity should be raised from its present level of some 275,000 ingot tons to 600,000 tons.

Other existing works in Turkey are small, the report states. A State-owned plant at Kirikkale, near Ankara, has an annual capacity of about 20,000 tons of alloy and special steels, and a privately-owned special steel plant recently built at Izmir, on the Aegean coast, has a capacity of about 15,000 tons per annum. A tube plant put into operation in 1957 at Izmit, on the Marmara Sea, is controlled by the German firm Mannesmann; it has an annual capacity of some 16,000 tons of welded tubes ½-2½ in. dia., at present made from tube strip imported from Germany. A privately owned tube plant at Istanbul has a capacity of 6,000 tons per annum.

Iron and steel production in Turkey in the last four years is shown in Table 1.

Construction of a new works at Eregli, on the Black Sea coast, is to start shortly. This privately-owned plant is to be financed partly in Turkey, partly with foreign loans, and partly by three US companies (Koppers, Blaw-Knox, and Westinghouse), who will also be responsible for the design and supervision of the works. The plant will include 2 by 80-ton oxygen converters and will produce exclusively flat products. Proposed capacity at Eregli in the three stages of construction (the third stage will not be completed until at least five years after the first) is as shown in Table 2.

TABLE 1.—*Turkish Iron and Steel Output, 1957-1960 (m. tons).*

	1957.	1958.	1959.	1960.*
Pig-iron	217,100	230,100	236,100	239,500
Crude steel	184,400	172,800	228,300	272,400
Rolled products	161,900	143,900	167,300	186,500
inc.: bars, sections, rails	141,000	120,000	140,200	154,800
flat products	20,900	23,900	27,100	31,700

* Annual rate in first nine months of the year.

TABLE 2.—*Proposed Capacity of the New Works at Eregli (m. tons).*

	1st stage.	2nd stage.	3rd stage.
Pig-iron for sale	—	220,000	220,000
Steel ingots	470,000	800,000	1,500,000
inc. ingots for Karabuk ..	110,000	170,000	170,000
Rolled products	268,000	470,000	1,000,000
inc. : plates up to 96 in. wide	55,000	70,000	—
hot-rolled coils	8,000	15,000	—
hot-rolled sheets ..	28,000	45,000	—
skelp	50,000	100,000	—
cold-rolled sheets ..	77,000	150,000	—
tinplate	50,000	90,000	—

Steel consumption in Turkey at present averages some 500,000 tons per annum, over half of which is imported. The BISF report states that, despite the probable increase in consumption, the large increases planned in production may well make Turkey self-sufficient in steel by the 1970s.

Titanium and Iron Potential of Iron Hill Ores

IRON HILL, in Gunnison County, Colorado, and the great mass of igneous rock of which it is the heart, contains large quantities of low-grade iron and titanium ores, according to the Bureau of Mines, US Department of the Interior. The estimate is based on surface sampling and diamond-drill exploration by the bureau. Ore specimens examined in bureau laboratories averaged 6.5 per cent. titania (titanium oxide) and 11.7 per cent. iron.

Iron Hill has been known to mining men since the 1880s and was first examined by the Bureau of Mines and the Geological Survey before the first world war. Of its wealth of minerals, however, only vermiculite has been mined. Bureau studies indicate the hard rock can be processed to yield from 11 to 38 per cent. of its total titanium content, but that the iron is not recoverable under present conditions due to difficulty of separating it from the titanium. Special techniques used in the diamond-drill exploration at Iron Hill and in analyzing the cores were adopted in connection with a bureau study of statistical methods as applied to ore sampling.

A 30-page report, illustrated with maps, drilling logs, and tables, and including a brief history of the deposit, is now available. The study was undertaken as part of the bureau's programme to investigate the nation's titanium and iron resources. Copies of Report of Investigations 5,679, "Cebolla Creek Titaniferous Iron Deposits, Gunnison County, Colo," can be obtained from the Publications-Distribution Section, Bureau of Mines, 4,800, Forbes Avenue, Pittsburgh 13, Pa.

REFLECTORS SAVE HEAT DURING FORGING

Research has shown that reflectors can considerably reduce heating time during forging by slowing down the cooling rate and thus permitting more forging per heat.

PRIMARY cause of heat loss from forgings at temperatures above 800 deg. C. is radiation, and it should therefore be possible to reduce this loss by reflecting the heat back on to the forging. Experiments in BISRA's Sheffield laboratories have shown that by surounding a hot bar with a polished aluminium tube the rate of cooling, during forging, could be reduced by a factor of one and a half. This means that a forging which would normally require three heats could be completed in two—a considerable saving.

In the research the reflecting material was formed into a tube completely surrounding the bar to be tested. Three materials—aluminium sheet, stainless steel, and mild-steel sheet—were tried; aluminium was proved to have better reflectivity, and to retain its reflectivity longer and at higher temperatures than the stainless steel; if it were raised to a temperature above 300 deg. C., the stainless steel oxidized quickly became dull and lost its efficiency as a reflector, whereas aluminium could be raised to a temperature of 600 deg. C. without noticeable deterioration. The reflectivity of mild steel was inferior to the two other materials.

The diameter of the reflecting tube determines the temperature of the reflector, and it also has an important effect on the conservation of heat in the forging: the smaller the diameter, the slower is the loss of heat. For this reason the ratio of tube diameter to bar diameter was tabulated in several experiments, and it was found that for aluminium sheet a tube about twice the diameter of the forged bar gave optimum heat conservation consistent with maintaining the reflectivity of the tube.

Forging experiments, with and without reflectors, were made on the BISRA experimental forge, and the results compared. The ingots used were of 8 in. square section. Special reflecting shields were designed for the forge, and these are illustrated in Fig. 1. On the free side of the press the shield was an aluminium tube of 15 in. dia.; on the manipulator side a tube was made up of segments with a radius of 9½ in., so that segments could be removed as the manipulator was moved into the press after each forging pass. The overall diameter of 19 in. on this side allowed the manipulator gripping jaws to be entered inside the shield.

These experiments demonstrate that properly designed reflectors would definitely be of economic advantage in forging and probably in other branches of steelmaking as well. For example, a simple reflecting tunnel might be used to cover the part of a forging extending outside the furnace during reheating; thereby reducing the temperature gradient along the forging. Reflector shields could also be used in the transportation of hot material, and to control the cooling rates during rolling of sheet and bar.

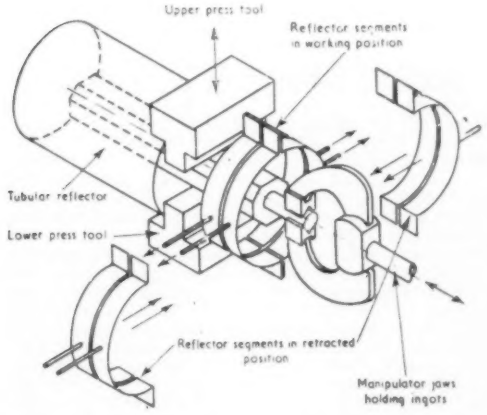


FIG. 1.—REFLECTOR INSTALLATION ON BISRA PRESS.

Imperial College of Science and Technology

The fifty-third annual report of the Governing Body of the Imperial College of Science and Technology for 1959-60 has recently been issued. According to the rector's report, the total number of full-time students increased to 2,656, the undergraduate intake being now about 600, while that for the postgraduates has risen to about 420, an increase of nearly 130 in five years. During the session a total of 717 degrees—235 higher and 482 first degrees—was awarded. Engineering degrees account for 59 per cent. of the total. There were 298 technologists among the 427 students who were awarded the DIC. About one third of the diplomates were also awarded higher degrees. Associateships were gained by 480 students, nearly all of whom also obtained a first degree. Over the past five years about 2,000 first degrees were obtained by students of the college, and about 1,800 higher degrees or diplomas. The rector's report briefly refers to various research work in progress.

COST CONTROL FOR MANAGEMENT

AT a meeting of the South Staffordshire, Warwickshire, Worcestershire and Shropshire Branch of the National Association of Colliery Managers, held at Sutton Coldfield on February 23, a talk on "Cost Control for Production Management," was given by Mr. J. W. Evans, deputy chief accountant of the Viscose Division of Courtaulds, Limited. He suggested that production management in his own firm was not unlike that of colliery management. Both industries were subject to severe competition. In the Viscose Division they faced competition from wool and cotton, not only in this country but in the European Common Market.

Raw material cost four times what it did pre-war, but selling prices were only twice as much. Ways and means had to be found of reducing costs by processing more efficiently and using better machines, and more day-to-day planning. There was continuing appreciation of keeping both costs and prices down. Most of the raw materials were bought centrally; production was planned centrally, and basic wage rates were negotiated nationally. Incentive bonuses were offered to all wage earners.

In his division the manager's job was to produce as cheaply and as efficiently as possible. He was also responsible for stocks, but he did not control the level of finished stock. A series of standard costs was adopted for each factory, but factories varied in that some machines were more modern than others.

Expenses moved in sympathy with production: some were variable, but there were others that were fixed and for which the company budgeted. Great difficulty was experienced in controlling repairs and maintenance costs. Comparing one factory with another, the machines in one would cost much more than in another. Guidance was given to factory engineers on the question of level of expenses according to the project involved and the type of machine used and its age.

One of the great problems was proper supervision in the right places to ensure that work was carried out properly. Statements of operating costs were produced monthly and studied by the directors. Labour was as great a problem with the company as with any other industry, and they had to ensure that absenteeism did not mean idle machines, said Mr. Evans.

Training of workers was a continuous process and the company provided most of its own services. It raised a great deal of its own steam and, therefore, the quality of coal supplied to it was of great importance.

UNDER a five-year agreement Burma is to export refined pig-lead, zinc concentrates, wolfram, tin, etc., to China, in exchange for coal, steel and other metals, and machinery.

National Coal Board Specifications

SPECIFICATIONS recently issued by the National Coal Board include those mentioned below. The charge for each specification is 6d. unless otherwise stated. The specifications are available from the NCB.

No. 158 (price 3s.) covers fire-resistant conveyor belting for use in the NCB and is a revision of specifications 113/1954 and 158/1958.

No. 226 relates to black cup and countersunk bolts, nuts, and washers.

No. 227 covers requirements for bright square head set-screws with flat chamfered ends, BSW and BSF threads.

No. 228 relates to precise hexagon bolts, screws, nuts (BSW and BSF threads), and plain washers.

No. 229 is applicable to both ferrous and non-ferrous screws and nuts having BSW and BSF threads and covers various types of screws with slotted and recessed heads.

No. 230 covers the rating, dimensions, and construction of two-pin side entry wall plugs and sockets for domestic purposes.

No. 231 relates to ferrous and non-ferrous slotted grub screws having UNC, UNF, BA, BSW, or BSF threads. General dimensions and requirements for material, finish, slots, and types of points are given, and tables of standard lengths are included.

No. 234 covers nine sizes of vitreous enamelled steel reflectors, commonly known as the "open dispersive type," having a light distribution classified in BS 398 as Class (A) 111. (Direct intermediate.)

No. 235 refers to plugs (fused and non-fused), socket-outlets (shuttered and non-shuttered), and fused socket outlet adaptors (shuttered and non-shuttered).

No. 236 relates to ferrous bolts, screws, and nuts, hexagon and square, with BSW threads, and partly machined bolts, nuts, and screws, hexagon and square, with BSW and BSF threads, and to the washers for use with them.

Further Education in Industry and Commerce

THE Federation of British Industries has published a handbook entitled "Further Education for Those in Industry and Commerce" to bring up to date the many different aspects of further education as they concern the employer and trainee in his employment. The booklet deals with recruitment and training, types of technical commercial colleges and courses, the growth of part-time release, the Industrial Training Council, group training schemes, the financial aspects of further education, and the employer's contribution to further education.

A summary of the recommendations of the FBI conference, "Invest in the Future," held at Buxton last September, is also included. Copies of the handbook are available from FBI Print and Publications, 21, Tothill Street, London, S.W.1 (price 6s., post free).

New Literature

SOME of the house magazines, catalogues, booklets, and other publications received are referred to below. Readers wishing to obtain a copy of any of the items are invited to write to the address given, at the same time mentioning IRON AND COAL.

TARMAC VINCULUM, LIMITED, Ettingshall, Wolverhampton—"Pre-cast Concrete Structures by Vinculum" is the subject of a four-page illustrated brochure.

INCANDESCENT HEAT COMPANY, LIMITED, Cornwall Road, Smethwick, Birmingham—A leaflet (No. 507) on "Nitrogen/Hydrogen Mixtures from Blast-furnace Gas" is now available.

FREDERICK BRABY & COMPANY, LIMITED, Braby House, Smithfield Street, London, E.C.1—The Braby of Britain Group's activities at home and abroad are recorded in interesting reports published in the February issue of Braby of Britain News.

CRODA, LIMITED, Cowick Hall, Snaith, Goole (Yorks)—"Promex" is a complementary product to the company's "Crocel!" range of thick film hot-dip strippable plastic coatings for anti-corrosion protection, and a useful booklet has been issued giving full information on the subject.

ALCAN INDUSTRIES, LIMITED, Bush House, Aldwych, London, W.C.2—The January issue of Aluminium News, just over from Canada, gives, in eight pages, a bright and lively review of latest developments in the aluminium field. The main feature is "New Horizons in Aluminium Architecture."

BRITISH TIMKEN, Duston (Northants)—Among the monthly magazines from the other side of the Atlantic, Timken is one to look out for. Each month there is a section devoted to news of the Timken Roller Bearing Company's division at Duston, but the remaining pages are often interesting, as they are in the latest (February) issue.

SAMUEL OSBORN & COMPANY, LIMITED, Clyde Steel Works, P.O. Box No. 1, Sheffield 3—Details of the new "Titanic" facing chuck and extra range are given in leaflet No. 22. The "Titanic" facing chuck has, it is claimed, all the advantages of screw-thread drive combined with a quick-release mechanism and a foolproof safety device.

SUFFOLK IRON FOUNDRY (1920), LIMITED, Sifbronze Works, Stowmarket (Suffolk)—Four new leaflets prepared by the company illustrate the research and development which is apparent in present-day welding techniques. They are:—"Super Silicon No. 9"; "Sifbronze Flux"; "SIF Stainless Steel Welding Wires," and "SIF Silver-solder."

THE ENGINEERING CENTRE, Stephenson Place, Birmingham 2—If you are an exhibitor at the Engineering Centre your products are seen by about 62,000 people every year, so we are told in the February News Letter. If you are not an exhibitor the publication will still interest you and might even influence you to share with others the benefits of exhibiting.

HEAD, WRIGHTSON & COMPANY, LIMITED, Ship House, 20, Buckingham Gate, London, S.W.1—"Electrostatic Precipitation Plant" is the title of an illustrated brochure which sets out to compare this method of gas cleaning with other systems. It then covers briefly the application of this equipment in the iron and steel industry. With the introduction of the Clean Air Act, equipment of this sort is becoming increasingly important and the range of equipment is being continuously extended.

GENERAL REFRACTORIES, LIMITED, Genefax House, Sheffield 10—Publication No. 124 GR is a useful guide to the selection and application of basic bricks for open-hearth furnace roofs. The company produces a full range of super-quality fired and metal-cased basic bricks designed to meet the various conditions in cold charged, mixed scrap and hot metal, and high hot metal processes.

MAGNESIUM COMPANY OF CANADA, LIMITED, P.O. Box 6090, Montreal—The Magcan Tabloid, the February number of which is to hand, is designed to give a quick portrayal of some of the interesting applications of magnesium in the world today. We quote: "It is difficult to depict what life will be like in the year 2060, but we will wager that magnesium will be used extensively. In this year 1961 the use of magnesium will increase and a new awareness of this light metal is being felt among users of diecastings. Nowhere has magnesium stood the test of years of use in the casting field and shown its capability and durability."

BRITISH OXYGEN COMPANY, LIMITED, Spencer House, St. James's Place, London, S.W.1—Torch, which has for the last six years been published by British Oxygen Gases, Limited, has now become the journal of the light industrial department of the British Oxygen Company. As in the past, it continues to deal with the uses of industrial gases in all their possible applications. A companion journal, ARC (previously known as Quasi-Arc Welding News), will make its appearance next month and will cover all aspects of electric arc welding. ARC will include articles on "Argonarc" and allied gas-shielded arc processes such as have in the past appeared in Torch.

International Galvanizing Conference

THE sixth International Galvanizing Conference is to be held at Interlaken from June 4 to 9. It is expected that about 500 galvanizers from many countries will meet to discuss the latest developments in the theory and practice of hot galvanizing.

Twenty-three papers will be presented by experts from Europe, Canada, Australia, and the US. There will be works' visits to jobbing plants in Switzerland and to strip, wire, and tube galvanizing plants in Italy. Exhibitions of equipment and materials used in galvanizing and of applications for galvanized steel are also being arranged.

Full details of the conference may be obtained from the Zinc Development Association, 34, Berkeley Square, London, W.1.

ACCORDING TO official statistics published in Rumania, targets for the first year of that country's six-year industrial plan were exceeded by 1,014,000 tons in pig-iron, 1,806,000 tons in steel, and 1,255,000 tons in rolled steel products.

Orders Placed

Substantial Contracts for Wellman Smith Owen

ORDERS amounting to some £2,000,000 have recently been placed with the Wellman Smith Owen Engineering Corporation, Limited, for steelworks plant and equipment. The contracts include rolling mill plant to the value of about £750,000 secured under the collaboration agreement entered into a short time ago between Wellman & Schloemann, AG, the well-known German rolling mill engineers. Another contract is for a LD/AC oxygen steelmaking unit for Stewarts and Lloyds, Limited, Corby, under the Wellman-VOEST agreement, including the supply of heavy duty cranes.

Wellman has also received a £270,000 contract from Shelton Iron & Steel, Limited, of Stoke-on-Trent, for mill cranes required on urgent delivery to be available for erection and servicing of its new rolling mills.

MANUFACTURERS of civil engineering plant, Goodwin Barsby & Company, Limited, Leicester, which is associated with Aveling-Barford, Limited, has secured a £35,000 contract for a large asphalt plant to be supplied to the Malayan Public Works Dept. It is the first of its kind to go to Malaya.

EXTENSION to the power station of the Workington Iron & Steel Company, branch of the United Steel Companies, Limited, is to be carried out by the Mitchell Construction Company, Limited. The £150,000 contract covers the construction of a steel-framed brick power station together with ancillary buildings.

HORIZONTAL EXTRUSION PRESS, capable of exerting a pressure of 5,500 tons, has been ordered by the Loewy Engineering Company, Limited, from the North Eastern Marine Engineering Company, Limited. It will be used for pressing aluminium at a German plant and will be 85 ft. long, 35 ft. wide, and weigh over 500 tons.

TWO CONTRACTS for lime-soda water softening plants have been awarded to William Boby & Company, Limited, Rickmansworth (Herts). The first will be installed at the St. Helens factory of Pilkington Bros., Limited, and will cost about £5,000, while the other has been ordered by the North Western Gas Board for its works at Crewe.

CLEARING DIVISION of US Industries, Inc., has secured orders for presses worth over £650,000 from General Motors-Holden's of Australia, Limited. Three large double action presses will be manufactured in the UK under the normal manufacturing agreement with Vickers-Armstrongs (Engineers), Limited, Newcastle-upon-Tyne, while seven large single action presses and four welding presses will be made in Australia in arrangement with Vickers-Ruwolt (Pty.), Limited, Melbourne.

CFA New Market Development Policy

IN our report last week of the Council of Ironfoundry Associations' decision to implement a new market development policy, Mr. Malcolm J. Glenny, chairman of the *ad hoc* Market Development Committee, was inadvertently described as chairman of the Joint Iron Council; he is, of course, chairman of the CFA.

The members of the new committee are (with the exception of Mr. E. K. Gould) members of the CFA executive committee and Mr. R. A. S. Lomax is chairman of the CFA training and education committee.

New Chain Testing Plant for Scotland

IT is hoped that Government assistance will be given towards a new chain testing centre to be set up at Coatbridge (Lanarkshire), by the North British Electric Welding Company, Limited, a member of Lithgows, Limited, group. An announcement by the group points out that at present the testing of large chains in the Midlands or in South Wales, involves transporting them for several hundred miles, although they might be bound for shipyards only a few miles from Coatbridge. Estimated cost of haulage adds between 10 and 15 per cent. to the price of some orders.

Lithgow's say that with the building of a new drydock at Greenock and the demand for heavy mooring systems in the Clyde, a top capacity testing plant is vital to the extension of chain and anchor production.

A new company, Lloyds Scottish Testing Company, Limited, will be backed by North British Electric Welding and by its selling agents, W. L. Byers & Company, Limited.

Plant being made available will be capable of placing a load of 500 tons on the heaviest cables. At present, Scotland's only testing plant can test up to between 250 and 300 tons.

INCO EARNS LESS

NET earnings of the International Nickel Company of Canada, Limited, for the year ended December 31, 1960, were $80,701,000 ($85,157,000), equal to $2.76 ($2.91) per common share. Reduced deliveries of nickel produced from the company's own mines and plants, higher costs for labour and services, and increased provisions for depreciation and income taxes, all had an adverse affect on the earnings.

On the other side, sales of rolling mill products increased, prices for the platinum metals rose, and there was an improvement in the deliveries of copper. During the year, the annual report states, Western Europe, including the UK, became a nickel market comparable to the US. Demand for nickel so far this year is about 5 to 10 per cent. below that of 1960. The European market is strong but the US demand for the metal, especially from steelmakers, shows no improvement. The company expects to maintain the 1960 deliveries of nickel from its own mines and plants during this year although the copper deliveries are expected to fall off.

Head Wrightson Joins US Technical Institute

FIRST British company to be accepted for membership of the Cooling Tower Institute, of America, is Head Wrightson Processes, Limited, a subsidiary of Head Wrightson & Company, Limited. The institute was formed in the US 10 years ago to advance the technology, design, and performance of industrial water cooling equipment.

For several years now Head Wrightson has associated with the Thior Products Company, of California, on a programme of research into improved methods of cooling. The partnership recently introduced a new range of cooling towers for small industrial duties.

Steel in Eastern Europe

PRODUCTION RISES AND EXPANSION PROJECTS

DETAILS of production and expansion in the iron and steel industries of the Communist countries of Eastern Europe are shown by figures recently issued by the various governments. In the Soviet Union, production of pig-iron in 1960 rose to 46,800,000 metric tons, an increase of 9 per cent. over the previous year, while output of raw steel also increased by 9 per cent. to 65,300,000 tons. Output of rolled products increased by 8 per cent. to 50,900,000 tons, and that of steel tubes by 12 per cent. to 5,800,000 tons.

This year the USSR is planning to build 17 open-hearth furnaces and three electro-steel furnaces with a total capacity of 7,200,000 tons a year, most of which are to be in operation by the end of the year. One of the open-hearth furnaces will have a capacity of 900 tons, which is a third larger than the present largest furnace now in use in the country.

Four blast furnaces are to be built this year, each with a capacity similar to that of the large-scale unit recently opened at the Krivoi Rog ironworks, and in the first half of this year all blast furnaces in the Ukraine will be converted to natural gas operation.

Czechoslovakia Boosts Output

Figures for Czechoslovakia show a 1960 output of 4,600,000 tons of pig-iron and 6,700,000 tons of raw steel, being respective increases of 10.6 per cent. and 10.3 per cent. over output in 1959. Output of rolled products rose by 11.6 per cent. to 4,400,000 tons. A needle ball-bearing plant has been opened at Brno; until now, these bearings have had to be imported.

Poland claims production in 1960 of 4,500,000 tons of open-hearth pig-iron, or 4.3 per cent. more than the previous year, and 6,600,000 tons of raw steel, a rise of 8.5 per cent. Some 4,400,000 tons of rolled products were manufactured, an increase of 9.1 per cent., while steel tube output rose by 9.9 per cent. to 365,000 tons. According to the Polish Central Statistics Bureau, three open-hearth furnaces and a block rolling mill were brought into use during 1960 at the Warszawa steelworks, an open-hearth furnace, a billet rolling mill and a tube production unit at the Lenin combine, and two coke batteries at the Bierut plant. The opening of a boiler plate plant at Warszawa and fine rolling and sheet galvanizing units at Lenin has been delayed due to supply difficulties and other causes. A tube and wire-drawing plant has also been opened in the Warszawa complex, and this year some 1,100 km. of steel tube and 6,000 tons of wire and rod will be produced.

In East Germany, pig-iron production rose by 5 per cent. to 1,900,000 tons, and that of raw steel by 4 per cent. to 3,300,000 tons. Production of hot-rolled steel was 5 per cent. higher at 2,480,000 tons, while that of secondary steel products rose by 10 per cent. to 493,800 tons. To reduce imports, the country's steel concerns have undertaken a number of above-target obligations for the current year. Maxhütte Unterwellenborn is to produce an extra 6,500 tons of iron blooms, 2,600 tons of ferro-concrete products and 1,000 tons of electro-steel; the Riesa steelworks and rolling mill 4,000 tons of quality steel and the Henningsdorf steel combine 2,500 tons of rolled wire. The Brandenburg steelworks and rolling mill will produce an extra 1,000 tons of boiler plates, the Olbernhau rolling mill 1,500 tons of fine sheet and medium plates, and the Ilsenburg rolling mill 500 tons of boiler plates above 1961 targets.

In Rumania, 1960 production of pig-iron rose by 20 per cent. to 1,014,000 tons, that of raw steel by 27 per cent. to 1,806,000 tons, and output of rolled products by 53 per cent. to 1,255,000 tons. Production of steel tubes rose by 23 per cent. to 338,000 tons, and that of ballraces by 29 per cent. to 4,553,000 pieces. The country also produced last year 24,554 tons of plant and equipment for the iron and steel industry.

Iron-ore Imports

THE appended table shows the tonnage and value of imports of iron ore and concentrates (except chrome iron ore and roasted iron pyrites) in January, 1961, and gives comparative figures for January, 1960.

From	Month ended January 31.		Month ended January 31.	
	1960.	1961.	1960.	1961.
	Tons.	Tons.	£	£
Sierra Leone	65,690	52,155	303,591	220,118
Canada	124,285	85,910	490,296	309,416
Other Commonwealth countries and Eire ..	3,450	2,500	14,100	8,992
Sweden	371,903	463,911	1,996,737	2,392,476
Norway	40,214	13,780	213,102	61,838
France	41,187	41,949	137,742	126,909
Portugal	40,517	15,455	156,906	54,284
Spain	42,524	53,006	179,482	216,358
Algeria	180,605	176,122	824,507	762,943
French West Africa ..	49,695	24,020	225,657	105,144
Tunisia	69,975	72,485	367,059	335,535
Morocco (excl Tangier)	61,300	36,812	312,259	188,143
Liberia	160,194	252,267	920,285	1,431,006
Venezuela	41,355	94,787	293,686	583,909
Brazil	60,199	44,467	219,874	222,827
Other foreign countries				
TOTAL	1,353,093	1,429,626	6,655,283	7,019,898

Dorman Long to Increase Iron and Steel Production

PLANS to raise pig-iron production from 1,500,000 tons to 2,000,000 tons and steel production from 2,500,000 tons to 3,000,000 tons within five years were announced on Monday by Dorman Long (Steel), Limited, Middlesbrough.

The group now produces 10 per cent. of the country's ingot steel and carries out 25 per cent. of all structural engineering and bridge building.

Board Changes

Executive Changes in Asquith Group

AMONG the several executixe changes announced by the ASQUITH MACHINE TOOL CORPORATION, LIMITED, group, is the resignation of Mr. G. W. Nicholls from the board of William Asquith, Limited, in order that he can devote more time to its associated company, Modern Foundries, Limited, of which he is managing director. Ormerod Shapers, Limited, and Kitchen & Wade, Limited, other members of the Asquith group, also announce changes.

Mr. E. Stott has resigned as managing director and from the board of Ormerod Shapers. He is suceeded by Mr. W. A. Hannaby who is to combine the office of managing director of that company with Kitchen & Wade. Mr. D. A. Farrar, assistant managing director of Ormerod Shapers, has been appointed a director of Kitchen & Wade.

NU-SWIFT, LIMITED—Mr. H. G. Stage has resigned from the board.

CRITTALL-HOPE METAL WINDOWS (SOUTH AFRICA), LIMITED—Mr. L. F. le Breton, has been appointed a director.

TARMAC CIVIL ENGINEERING, LIMITED—Mr. W. N. Cook has joined the board of the company, a member of the Tarmac, Limited, group.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LIMITED—Mr. K. A. Robinson has joined the board of the company, which is a member of the Metal Industries, Limited, group.

G. & J. WEIR HOLDINGS, LIMITED—Mr. John W. Atwell, managing director of the principal operating subsidiary G. & J. Weir, Limited, has been appointed an additional director.

HALESOWEN STEEL COMPANY, LIMITED—Col. P. H. Jones has been appointed chairman in succession to Mr. C. S. Burch who retired in January. Mr. H. W. Homer has been appointed deputy chairman.

RENOLD CHAINS, LIMITED—Mr. L. J. Tolley, works director, has been appointed a deputy managing director, additional to Mr. W. S. C. Tully. Mr. E. E. Hempsall has been appointed general works manager to succeed Mr. Tolley.

DELTA METAL COMPANY, LIMITED—Mr. A. F. Thomas, who joined the board in 1956, has been appointed an assistant managing director. One of his first duties in his new capacity is a 10-day visit—he left on Monday—to the associated companies in South Africa.

JOHNSON & PHILLIPS, LIMITED—Mr. L. J. Brown and Mr. H. D. Walker have joined the board. Sir Richard E. Yeabsley, having accepted an invitation to join the board of Bailey (Malta), Limited, will not, in view of this appointment and his other commitments, offer himself for re-election to the board when he retires by rotation at the next annual general meeting.

INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED—Mr. Ivon A. Bailey has been elected a vice-president and Mr. John O. Hitchcock an assistant vice-president, effective from April 10. Mr. Bailey remains chairman and chief officer of the International Nickel Company (Mond), Limited, and of Henry Wiggin & Company, Limited, and Mr. Hitchcock remains managing director of the International Nickel Company (Mond), and deputy chairman of Henry Wiggin & Company. He will also continue as second chief officer of both companies.

Exchequer Blamed for "Cheap and Shoddy" UK Goods

BECAUSE of the need to protect the home market, more and more manufacturers are producing cheap and shoddy products in order to achieve the sales advantage of "low deposit" in their home market, maintains the chairman and managing director of Cannon (Holdings), Limited, Mr. A. F. Oatley. His company, he points out in his annual review, specialized in the past in being the best in one major high-grade product, contributing to the reputation that "British Made" meant "the best in the world." Constant variations of credit control and purchase tax had forced the company to abandon this policy, which "provided for extensive enlarging and modernization of factories, a substantial reserve, and not ungenerous dividends," Mr. Oatley declares.

"This universally-hated legislation has already firmly set the pattern of a widening policy which is doing more harm abroad to the reputation of 'British Made' than any healthy normal competition could possibly do. Furthermore, no manufacturer is encouraged to venture with confidence and enthusiasm into export markets for contracts based on the economics of his home markets so long as he fears that they will turn into liabilities because of the legislative wrecking of his home market economy, upon which he must base his export approach," he says.

Mr. Oatley adds weight to his argument by pointing out that the manufacturers of capital goods in the UK—who are not affected by these sudden economic changes—are steadily increasing their exports, profits, and employment record and are continuing to uphold British quality abroad. "How in all honesty," Mr. Oatley asks, "can the Government continue to chant the patriotic need to promote more exports while maintaining this Fifth Column continually engaged in sabotaging the very effort they seek to encourage?"

TAXATION JEOPARDIZES EXPORT EFFORT

IRONY of the Government taxing companies heavily on profits, while urging that greater efforts should be made in the export field is referred to by Mr. Edward Walters Senior, chairman of Padley & Venables, Limited, makers of compressed air equipment and processors of stainless steels, of Sheffield, in his annual review. Competition in world markets, he declares, "is jeopardized by forcing companies to push their prices as high as they can to enable them to provide for the necessary development and expansion of export markets."

Direct export sales of the company now total some 25 per cent. of the pneumatic tool turnover—higher than ever previously reached, Mr. Senior reports. While not exactly "fun" to export, since it is more expensive than selling to the home market, it is exciting and often rewarding. "It is our firm intention to continue the journeys, inquiries, research, modification of manufacturing methods, and changes of specification which inevitably come with export business, because we know it to be essential to our national economy and to the development of the company," he maintains.

SOUTH CROFTY, LIMITED—Mr. A. F. Taylor has been appointed a director.

Company News

STEEL ISSUES SUCCESS

£316,000,000 Nominal Applications

ABOUT 47,600 applications were received for £136,000,000 nominal of the steel company prior charges offered for sale last week by the Iron and Steel Holding and Realisation Agency. Nominal value of the stocks offered amounted to £105,260,000, but they were marketed for just over £85,000,000. Except in the case of the offer of £40,000,000 5½ per cent. debenture stock of Steel Company of Wales, Limited, all the offers were oversubscribed.

An announcement by ISHRA said that applications for SCOW stock, including all special applications from underwriters, totalling some £35,000,000 had been accepted in full, and, in addition, sub-underwriters had been called upon to take up £500 stock per unit sub-underwritten. In the case of the remaining offers, approximately 68 per cent. of each security has been absorbed by special applications from underwriters who had asked the agency to accept their applications in full. Dealings in all the securities started on Monday. The basis of allotment for the remaining offers is as follows: Colvilles, 4½ per cent. debenture, 1975-85, £10,000 in full, above 50 per cent., with maximum of £33,000; 5½ per cent. cumulative preference, 100 shares in full, above 24 per cent. with maximum 5,000 shares; Consett Iron, 5 per cent. redeemable debenture, £20,000 in full, above 41 per cent. with no maximum; Dorman Long, 4½ per cent. unsecured loan stock, £500 in full, above 35 per cent., maximum of £5,000; 5½ per cent. cumulative preference, 700 shares in full, above 18 per cent., maximum of 20,000 shares.

United Steel, 4¾ per cent. debenture, £5,000 in full, above 57 per cent., maximum £15,000; 4½ per cent. cumulative preference, 300 in full, above 28 per cent., maximum 10,000 shares; 5¾ per cent. redeemable cumulative preference, 300 in full, above 23 per cent., maximum 10,000 shares; Stewarts and Lloyds, 5½ per cent. cumulative preference, 2,000 shares in full, above 49 per cent., maximum 20,000 shares; 5½ per cent. redeemable cumulative preference, 1,500 in full, above 14 per cent., maximum 20,000 shares; John Summers, 5½ per cent. cumulative preference, 400 shares in full, above 15 per cent., maximum 10,000 shares.

THOS. W. WARD, LIMITED—Interim dividend for the year ending June 30, 1967, is raised from the equivalent of 2½ per cent. to 3¼ per cent.

CHARRINGTON, GARDNER, LOCKET & COMPANY, LIMITED—An interim dividend of 4 per cent. on the 5s. ordinary stock units has been declared.

GENERAL REFRACTORIES, LIMITED—Final dividend of 17½ per cent. makes 25 (20) per cent. for 1960. Group net profit rose to £622,278 (£408,229), after tax of £667,821 (£357,090).

RUBBEROID COMPANY, LIMITED—In view of the marked rise in the price of the ordinary shares in recent weeks, the directors wish to state that no negotiations have been entered into, but if and when there is anything to report, shareholders will be fully informed.

CONSOLIDATED SIGNAL COMPANY, LIMITED—Net profit for the year ended September 30, 1960, was £53,420 (£53,282) and the dividend is raised by 5 per cent. to 50 per cent.

THOS. FIRTH & JOHN BROWN, LIMITED—Of the 4½ per cent. redeemable debenture stock, 1980-85, £17,400-worth has been purchased and cancelled, leaving £2,837,250 in issue.

MONSANTO CHEMICALS, LIMITED—Group net profit for the year ended December 31, 1960, was £1,700,342 (£1,693,266), after tax of £1,251,016 (£1,194,396), and the final dividend of 10 per cent. makes a 15 per cent. total.

MINING ENGINEERING COMPANY, LIMITED, manufacturers of underground mining machinery, of Worcester—The company has recently acquired Jones & Attwood, Limited, foundry and general engineers, of Stourbridge (Worcs).

CLAYTON DEWANDRE, LIMITED, vehicle equipment manufacturers, of Lincoln—Final dividend of 10 per cent. makes 15 (12½) per cent. for 1960. Net profit was £367,559 (£283,763), after tax of £221,500 (£292,000).

DESOUTTER BROS. (HOLDINGS), LIMITED—Final dividend of 28½ per cent. effectively raises the total dividend for 1960 to 35 (30) per cent. Group net profit was £436,928 (£375,030), after tax of £418,546 (£355,350).

HALL & COMPANY, LIMITED—It is proposed to merge with Thames Grit & Aggregates, Limited, into a new holding company to be called Hall & Ham River, Limited. The merger will be effected by an exchange of shares.

GLOUCESTER RAILWAY CARRIAGE & WAGON COMPANY, LIMITED—No interim dividend is to be paid for the year ending May 31, 1961. Last January Sir William Morgan, chairman, revealed that the Gloucester wagon works was running at a substantial loss.

HEPWORTH IRON COMPANY, LIMITED—The group has acquired for cash 80 per cent. of the issued share capital of Fred Temperley & Son, Limited, which, with its wholly-owned subsidiary, J. Duckett & Son, Limited, operates sanitary pipe manufacturing works at Todmorden and Burnley.

HALKYN DISTRICT UNITED MINES, LIMITED—The capital is to be reduced from £250,000, divided into £82,270 ordinary stock and 1,677,297 ordinary 2s. shares, to £208,864 divided into £41,135 ordinary stock and the same number of ordinary shares, by

repaying 1s. to holders for every 2s. of stock. The 2s. shares will then be sub-divided into 3,354,594 ordinary 1s. shares and a further 822,703 such shares will be created bringing the capital up to £250,000 again.

P. M. PATHE (ENGINEERS), LIMITED, Sheffield—To overcome shortage of space and engineering capacity the entire share capital of Wassell & Clayton, Limited, engineers, of Sheffield, has been acquired. The company has moved its head offices to the premises of the new subsidiary in Broomhall Street.

BROWN BROS., LIMITED, ferrous and non-ferrous metal stockholders, etc., of London, E.C.2—Final dividend of 13 per cent. maintains the total dividend at 17½ per cent. for 1960, as forecast, on capital increased by a one-for-six rights issue. Group net profit was £425,664 (£453,755), after tax of £449,425 (£482,387).

CAMBRIDGE INSTRUMENT COMPANY, LIMITED—Dividend for 1960 is being raised from the equivalent of 20.41 per cent. to 22 per cent. less tax, on a capital increased by an acquisition, with a final of 6 per cent. An unchanged 4 per cent. interim, less tax, is declared for 1961. Net profits were £283,592 (£256,965) after tax of £243,604 (£212,925).

NU-SWIFT INDUSTRIES, LIMITED, manufacturers of fire-fighting equipment, of Elland (Yorks)—Dividend of 30 per cent. is to be paid for 1960, against a forecast of 25 per cent. when the shares were introduced in January, 1960. Group net profit was £106,424, after tax of £96,292. Mr. F. P. J. Graucob, chairman, has waived all right to receive in respect of 1960 any dividend of the 792,602 1s. shares owned by him.

BURT BOULTON & HAYWOOD, LIMITED—To consolidate the tar distillation interests and expand the chemical manufacturing interests, the 50 per cent. of the capital of Burts & Harvey, Limited, which is not already held is to be acquired. The privately held shares have been valued at £487,500 and the purchase consideration of that amount is being satisfied by £53,188 cash and the issue of 25,000 £1 7 per cent. preference and 185,000 £1 ordinary shares.

WOODHOUSE & RIXSON, LIMITED, manufacturers of steel crankshafts, forgings, etc., of Sheffield—Due to lower prices when work was difficult to obtain in the early part of 1960 and to the shorter working week, the trading profit showed only a 13 per cent. increase to £162,218, while sales were up by 24½ per cent., in the year ended December 31, 1960, states Mr. Sydney E. Baker, chairman. Final dividend of 4d. per unit makes 5d. for the year.

W. G. ALLEN & SONS (TIPTON), LIMITED—Although no interim dividend is being declared for the period ending March 31, 1961, Mr. R. Hampshire, chairman, says that the position has improved. There was no ordinary dividend for 1959-60 when a net loss was incurred. Both the parent and subsidiary companies now have full order-books and group results for the year should be a little better than was earlier expected. An extra-ordinary meeting has been called for March 28, at which it is proposed to increase the permitted borrowing powers.

F. W. BERK & COMPANY, LIMITED, chemical manufacturers and bonding clay specialists, of London, W.1—Profit before taxation for the year to December 31, 1960, was £679,000 (£522,520). A final dividend of 6d. per share on the 5s. ordinary shares is recommended, which makes a total of 8½d. (7½d.) per share. Provisional arrangements have been made to acquire on a share exchange basis the whole of the share capital of St. Albans Sand & Gravel Company, Limited, a private company with a net book asset value of £633,000.

Third Oxygen Plant for Spencer Works

THIRD 200-tons-a-day oxygen plant is to be built by the British Oxygen Company, Limited, for the Spencer Steelworks, Llanwern (Mon), of Richard Thomas & Baldwins, Limited. Scheduled to begin operating in 1963, the plant will take BOC's daily capacity at the Spencer works to a total of 600 tons of high purity oxygen. In three year's time BOC's capacity in South Wales will have risen to almost 2,000 tons a day—more than half the total for the entire UK steel industry.

Planning the fabrication of the new RTB unit is now proceeding at the Edmonton, London, engineering works. In addition to piping oxygen to the three 100-ton LD converters, BOC will supply substantial quantities of high purity nitrogen-hydrogen mixture for the annealing furnaces.

Improvement in Orders Position of Asquith Machine Tool

REPORTING that the order-book position is very much better than a year ago, Mr. Robert W. Asquith, chairman of the Asquith Machine Tool Corporation, Limited, adds that the lower level of profitability on manufacture of special machines and the continuing tendency for lower margins, together with the difficulty in obtaining labour, must be borne in mind. The group is not intending to resume interim dividends this year, but results to date show some improvement over the same period last year, and providing conditions remain normal, an increase in dividend over the 5 per cent. being paid for the year to September 30, 1960, is foreshadowed.

Investment in the associated company, Warner Swasey Asquith, Limited, increased by some £300,000, and a further £200,000 investment is expected this year. Excellent progress is being made, but it will be some time before the company can expect a dividend on its investment, says the chairman.

900,000 Tons of Steel Ousted by Plastics in ECSC by 1965?

EXPERTS' report issued by the High Authority of the European Coal and Steel Community in Luxembourg states that in the ECSC area, by 1965, some 900,000 metric tons of steel will be replaced annually by plastics. This represents 1.5 per cent. of total community production. In 1955 some 150,000 tons of steel—or 0.4 per cent. of production—was replaced by plastics.

The main competitors in the plastics field are polystyrene, polyethylene, polyester, and polyvinyl chloride. Aluminium is expected to replace 2.6 per cent. of steel output by 1965, some 600,000 tons of the metal replacing 1,800,000 tons of steel. The higher cost of aluminium, however, represents in the eyes of the experts a considerable advantage for steel.

TRAINING CENTRE has been established by Shawnee Poole, Limited, makers of earth-moving equipment, at its Woodley (Berks) headquarters, at which dealers, representatives, servicemen, and operators, may undergo seven-day courses.

IRON AND STEEL TRADE

CURRENT production and consumption are now more closely in line and earlier delivery dates can be obtained for most products. The situation has eased in respect of heavy sections and joists, heavy and medium plate, bars, and flat rolled products generally, but the demand for universal beams is still strong, both from the engineering and the contracting industries. The large stocks held by many merchants and consumers at the end of the year should have been reduced by now to more normal levels, but there is still an easing off in forward ordering.

Pig-iron

Demand for low phosphorus and other grades of pig-iron has been fully maintained, but there is, as yet, no departure from the short-buying policy that has been a feature for some time now. The call from the steelworks for basic pig-iron is well sustained and is satisfied almost completely by home furnaces, imports having fallen off correspondingly.

The shortage of suitable scrap continues to necessitate a larger percentage of pig-iron than normal in steelmakers' mixtures. The foundries have no difficulty in securing all the supplies of pig-iron needed, both for consumption and stock, and only one or two brands of low phosphorus irons and hematite are limited in supply.

Ferro-alloys

After remaining unchanged for a brief period there has been another reduction in the price of ferro-tungsten which now stands at 10s. 3d. per lb. W. contained. Tungsten metal powder is similarly reduced to 13s. 3d. per lb. The demand for the former is relatively steady and ferro-vanadium and ferro-molybdenum are in fair request. Ferro-silicon is well supported, and both the low- and high-carbon grades of ferro-chrome continue to attract reasonable attention.

Interest in ferro-niobium is maintained and there is some demand for ferro-titanium. Silicon metal is of slightly more interest.

Semi-finished Steel

There are few complaints from the re-rollers, most of whom are satisfactorily occupied. Whilst current business shows some decline on that previously placed for small bars, light sections, hot rolled strip and bright drawn bars, there is still a heavy call for reinforcing rods.

Until re-rollers' stocks of mild steel semis, which include consignments from oversea, are reduced far more than at present applies, they are not likely to make any urgent call on the steelworks where tonnages available are well in excess of requirements.

Finished Steel

New business is not now so easily come by and there are reports that a number of consumers are asking for present orders to be deferred. In consequence, more sizes have been appearing on the steelworks' weekly rolling programmes, but production has not been affected, as yet, to any great extent. Rolling dates for some sizes of small angles, flats, rounds, etc., have been shortened due to the falling off in demand.

Orders for cold reduced sheets are being accepted for fairly quick delivery, the improvement in the motor-car industry not having had a great deal of effect on the current position.

Ore Chartering

MISCELLANEOUS ore fixing appears to be quiet, although from Marmagoa there are reports of 9,500 tons being fixed to the Adriatic with April cancelling at 52s. f.i.o. and Marmagoa/Savona paid 45s. 6d. f.i.o. for similar size, March 5/25. Tonnage is required from Marmagoa to Antwerp-Hamburg Range, any size, prompt and forward loading, with about 49s. f.i.o. indicating. Poti/Rotterdam-Vlaardingen fixed 9,600 tons for May at 31s. 6d. and manganese from Port Elizabeth to Oxelosund fixed 7,000 tons, 10 per cent., for April 5/May 5 at 54s. f.i.o.

Although there is some inquiry from the French North African coast to the Continent, chartering is slow to develop but pyrites from Morphou Bay to Rotterdam, Vlaardingen, or Pernis paid 27s. for 12,000 tons, March 1/20. There is some inquiry for tonnage to load bauxite from Toulon to South Wales for forward shipment and Itea-London quotes 33s. 6d. for April and about 22s. 6d. to Caronte for late March.

Corrosion Engineers Link with German Company

SUBSIDIARY of John Mowlem & Company, Limited, Corrosion Technical Services, Limited, has been appointed sole UK agents for Dr. Otto Saurebau und Keramikwerke of Bendorf/Rhein, one of the leading German companies specializing in the design and erection of pickling plants, both continuous and batch processes, for the steel industry and in the complementary acid recovery and effluent treatment plants.

In conjunction with its parent company, Corrosion Technical Services can now offer a complete service in continuous and batch pickling plants from the design of the actual plant to the construction of the foundations and the final erection of the plant and ancillary equipment.

TRAINING FOR THE FUTURE

"LEADERSHIP and survival of the British iron and steel industry is going to depend on our skill, knowledge, and enterprise," Mr. Michael Bury, head of the labour and training department of the British Iron and Steel Federation, told apprentices at Stewarts and Lloyds, Limited. Speaking at the annual prize-giving he said that the whole future of the industry depended on recruiting the best people available and training them well.

Facilities and openings in the industry and in colleges were greater than in the past, Mr. Bury said, but there were not too many when there was so much more to learn and a higher standard to attain.

Coalfield News

City and Guilds Awards for Kiln Burners

PRESENTING City & Guilds certificates in kiln burning to nine workmen and officials of National Coal Board brickworks in Northumberland, Mr. C. A. Ritchie, chief engineer, Northern (N&C) Divisional Coal Board, said: "I congratulate you on your moral courage in taking up a course of studies at your age."

All nine recipients, he said, were over the age of 40. They had given the division the distinction, not only of having the largest number of entries for the examination, the first to be held, but also the highest percentage of passes (nine out of 19). The presentation was made at a social evening at Backworth, presided over by Mr. W. Lambert, divisional brickworks manager.

TOTAL OF THE Six Bells Colliery Disaster Fund now exceeds £102,200.

VERDICT OF Accidental Death was recorded at the Swinton (Yorks) inquest on Mr. M. S. Thomas (50), a miner, who was fatally injured in a pit fall at Kilnhurst Colliery.

STRIKE in the Yorkshire coalfield resulted in the coal shipments from the port of Goole dropping by 20,000 tons last week and many shippers fear that the setback may have far reaching effects.

COAL TIP at Britannia Colliery, Pengam (Mon), which has been on fire and giving off fumes, is to be damped down with an inert dust, the crevices sealed up, and then levelled off. The tip is about 400 yds. away from a number of houses.

DURING JANUARY there were 219,626 tons of coal shipped from the port of Sunderland, an increase of 6,071 tons compared with January last year. Total shipped abroad was 41,522 (29,750) tons and 178,104 (183,805) tons shipped coastwise.

FOR THE THIRD TIME in five weeks productivity in the Cannock Chase Area of the West Midlands Divisional Coal Board has broken previous records. Output per manshift at the face in the week ended February 25, was 97 cwt.—1½ cwt. up on the previous week's record.

OVERALL PRODUCTIVITY in the Durham Division of the NCB for the first eight weeks of this year has reached an average of 22.96 cwt. per manshift, compared with 21.92 cwt. per manshift in the corresponding period of 1960. At the face productivity reached 65.56 (64.46) cwt.

OUT OF 3,519 BOYS leaving school in mining areas in Derbyshire last year, only 15 per cent. entered the mining industry. Announcing this, a report of the county council youth employment service attributes the low figure to the suspicion of boys and their parents about the future of the industry—despite the vigorous NCB publicity campaigns.

NUMBER OF MEN employed by the East Midlands Division of the NCB is still declining, but the rate at which men are leaving the industry is slowing down. During 1960 the number employed in the division fell by 5,200 to 92,300. In the first nine months of the year men left at the rate of 1,450 every three months, but in the last quarter the loss was about 900.

COAL AND COKE SHIPMENTS through the South Wales ports last week totalled 43,002 tons, compared with 54,435 tons in the corersponding week of 1960. Tonnages shipped from the individual ports (with 1960 tonnages in parentheses) were as follow:—Newport, 7,053 (8,468); Cardiff, 5,487 (11,635); Penarth, 3,319 (3,921); Barry, 8,881 (14,796); Port Talbot, 1,414 (1,197); Swansea, 16,848 (14,418).

ORDER OF INDUSTRIAL HEROISM is to be awarded by the Daily Herald to the local branch of the National Union of Mineworkers at Hickleton Main Colliery (Yorks). The men at the pit worked for 18 hours in constant danger of roof falls to save seven men who were trapped behind a fall. The award will be made tomorrow (Saturday) by Mr. Alfred Robens, chairman of the National Coal Board.

MINERS IN 32 Derbyshire pits are to get an extra five minutes to eat their meals. From next month they will have 20-minute meal breaks. It was claimed by the Derbyshire NUM, which took the case to arbitration, that because of mechanization, the men have to walk farther along the coal face to get their break and this took up more time. The move was opposed by the National Coal Board, who said that 15 minutes was the traditional time and in many cases the men did not take the break.

FOUR MEMBERS OF THE Crofton and Cowpen (Northumberland), Miners' Welfare Committee who between them, have more than 100 years' service, have parted company. Mr. Joseph Hepple, a retired checkweighman and chairman of the Welfare Committee for 33 years, and Mr. George Kinsman, correspondence secretary for 21 years, have retired, leaving behind them on the committee Mr. Tom Anderson (31 years' service) and Mr. George Laing (20 years' service). The total length of service of the four is thought to constitute a record in miners' welfare work.

Mr. Robens Meets Labour Fuel and Power MPs

CHAIRMAN of the National Coal Board, Mr. Alfred Robens, met the fuel and power group of Labour MPs in the House of Commons on Tuesday. He told them that coal was on the threshold of a period of "real prosperity" and that he looked forward to a period of stabilized prices and reduced costs.

Mr. Robens said that he was lucky to have taken over at a time when much of the capital investment was beginning to pay off in a big way. He pointed out that 40 per cent. of the country's pits were power loaded, although only a small proportion of the machinery was being operated for more than one shift a day. His aim was to get power loading on to two or even three coal-cutting shifts—as long as the miners agreed.

Mr. Robens is to address the Conservative MPs fuel and power group next week.

UK Trade Mission to Visit Far East

BRITISH trade delegation is to visit seven South-East Asian countries in April to explore prospects, the Federation of British Industries announced on Monday. The delegation will be led by Sir Edward Thompson, chairman of John Thompson, Limited, and the delegates will represent a wide range of the industries interested in the nations to be visited. The decision for such a mission was taken after talks between the FBI and the Board of Trade.

On its return to the UK the mission will report to the Government. Four simultaneous delegations will make a two-week tour of Thailand and Burma, Malaya and Singapore, the Philippines and British Borneo, and Indonesia.

THE COAL TRADE

RARELY does the weather conspire to ease the overall situation in the coal trade, but on this occasion the June-like conditions will do much to offset the difficulties caused by the Yorkshire coalfield strike. Pressure is still maintained for deliveries, but it is not so desperate as it would have been had the country experienced a cold spell. The steady demand for industrial qualities is being met with reasonably prompt deliveries and the call for all grades of hard and gas coke shows no signs of falling off.

DURHAM AND NORTHUMBERLAND

Markets generally have displayed a tautness which renders them less flexible to loss of output, such as was occasioned by the Yorkshire stoppage. This applies more especially to superior large and graded classes of steams which hold a firm position and have a considerable volume of trade over the coming weeks.

Recent milder weather has brought a more casual note to household trade, but general industrial demand for steams is consistent and power stations are taking larger quantities of inferior steams than a year ago. Regional demand for these classes has increased, and coastwise shipments are also higher with the result that stocks are showing gradual diminution.

There is a rather easier note on the export section, and more business would be welcome for Durham gas coal. Durham industrial cokes and coking coal are all readily taken up and there is a fair domestic trade for household cokes. Branded smokeless fuels continue in popularity.

DERBYSHIRE

Better weather has helped in easing the overall position with regard to household coal supplies. There is still a pressure for delivery and full contract tonnages are being taken by all merchants. Best and hand-picked qualities are stable, with a normal demand being met promply from fresh supplies. The better types of screened cobbles and brights are subject to steady pressure, and with fairly regular forwardings, delays are not great. Cheaper brights remain more popular, and all available tonnages are readily taken up. Best large nuts are a little easier with forwardings consistent to meet a strong demand. Washed medium nuts and washed doubles are scarce and nothing is available outside normal contract commitments.

There is steady pressure for domestic coke nuts, and deliveries are proceeding satisfactorily from good stocks at local works. Demand for all premium smokeless fuels is well maintained, but delays persist. Coalite and Rexco are very difficult to obtain, while Cleanglow and Warmco are easing a little. Domestic anthracite remains scarce and orders have to be placed many weeks ahead with producers. Beans are difficult, while grains are subject to less delay.

Demand for industrial coals remains firm, though there is a steady flow of supplies. Nutty slacks are in fair request and deliveries are well maintained. Dry screened nuts continue to be keenly sought, and all available tonnages are readily absorbed. Hard steam coals are in fair request, and deliveries are adequate. Washed fuels remain subject to strong pressure, and the demand still causes a considerable build-up of transport at local pits.

All grades of hard gas coke are in demand, although there is an easing in pressure compared with recent weeks. Delays in the forwardings of fuels by rail continue.

Effect of Strike on Coal Output

YORKSHIRE miners' strike cost coal output last week over 500,000 tons, bringing total output down to 3,436,800 tons, compared with an average for the first 8 weeks of the year of 3,800,000 tons. Consumption (including exports and bunkers) is running at an average of 4,684,000 tons weekly, giving a debit balance of 884,000 tons a week on average to be found from stocks. In the week ended February 25, these had dropped to 24,429,000 tons, compared with 33,000,000 tons a year ago.

There were 582,350 wage-earners on colliery books on February 25, against 623,410 on February 27, 1960, the numbers engaged at the coal face being 219,280 and 238,910 respectively. Total absenteeism (all workers) in the week ended February 25, was 16.16 per cent., compared with 15.61 per cent. in the week ended February 27, 1960. Output at the face was 4,095 tons and overall 1,419 tons in the week ended February 25, compared with 3,974 and 1,416 tons in the week ended February 27.

The following table gives (in tons) the revised output of saleable mined coal by division in the week ended March 4, and the tonnage lost through all causes (holidays, disputes, and go-slows):—

Division.	Week ended March 4, 1961.		Week ended March 5, 1960.
	Total output.	Tonnage lost.	Total output.
Scottish	353,000	4,000	374,000
Northern (N&C) ..	242,000	1,000	243,000
Durham	462,000	1,000	475,000
North-Eastern ..	313,000	542,000	836,000
North-Western ..	245,000	1,000	273,000
East Midlands ..	908,000	4,000	926,000
West Midlands ..	289,000	1,000	300,000
South-Western ..	377,000	9,000	420,000
South-Eastern ..	32,000	—	30,000
Great Britain—			
Deep-mined coal ..	3,221,000	563,000	3,877,000
Other deep-mined (including licensed mines) ..	41,000	—	53,000
Open-cast coal ..	175,000	—	169,000
TOTAL	3,437,000	563,000	4,099,000

LUXEMBOURG last year produced 3,780,000 metric tons of pig-iron and 4,100,000 tons of raw steel, increases of 13 per cent. and 12 per cent., respectively, over output in 1959. The production totals were a record. Output of rolled steel products increased by 10 per cent. to 3,250,000 tons, of which 3,000,000 tons were exported.

Doncaster Miners Vote to Continue Strike

IN spite of resumption of work early this week by the majority of pits involved in the Yorkshire coalfield strike, the Doncaster miners' panel, representing 27,000 miners at 11 collieries mainly responsible for the strike, decided on Tuesday to continue the stoppage. They are to approach the Yorkshire executive of the National Union of Mineworkers, which has refused to recognize the strike, to ask for a hearing of the case for a 10 per cent. increase in coal-face workers' contract rates, and a guaranteed shift wage of 65s.

The 1,000 miners at Walter Haigh Colliery, near Leeds, where the strike started 18 days ago, resumed normal working on Tuesday, and by Wednesday there were only 14 pits totally idle, and one partially, with 6,268 men on strike, compared with 50,000 last Friday. Coal tonnage lost up to this time was nearly 700,000 tons.

The return to work at many pits which began on Monday followed an appeal last Friday by Mr. S. W. Ford, president of the NUM. Condemning the unofficial action, Mr. Ford said it constituted a serious threat to the future of the coal-mining industry and the security of those who depended on it. "The loss of even a small part of our industrial and domestic trade to oil as a consequence of our inability to meet the demands of the customers can have the most serious repercussions on this industry, and is especially unfortunate at a time when the industry seemed to be moving out of the doldrums of the past three or four years."

The Yorkshire Area of the NUM circularized its 120,000 members in the coalfield urging strikers to return, and saying they had been misled by "irresponsible wreckers." Mr. Fred Collindridge, secretary of the Yorkshire miners, appealed for a return to work in view of the "suffering and hardship" which was bound to follow in the wake of the dispute. The union, he said, could then resume negotiations with the National Coal Board on piece-rates. These had been going on for months, and discontent over progress in the negotiations had sparked off the present strike.

Mr. Sam Bullough, the Yorkshire miners' president, and Mr. Collindridge attended a meeting of the NUM national executive committee in London yesterday (Thursday), called to discuss the strike.

Apart from a decision by the 1,250 miners at Wath Main Colliery to return to work "under the strongest possible protest," the position in the Yorkshire coalfield yesterday remained very much the same. One pit was partially idle and 13 totally, with a total of some 5,000 men on strike. The NCB said yesterday that since the strike began it has cost some 750,000 tons of coal.

Recent Wills

ROSS, S. C., co-founder of Richards & Ross, Limited, tube benders, of Wednesfield, Wolverhampton ... £14,278

HARRISON, T. S., a founder of T. S. Harrison & Sons, Limited, machine tool manufacturers, of Heckmondwike (Yorks) ... £12,080

GARDNER, ALBERT, a director and commercial manager of Cammell Laird & Company (Shipbuilders & Engineers), Limited, Birkenhead ... £19,656

FIELD, STANLEY, head of the accounts department of Accles & Pollock, Limited, seamless steel tube manufacturers, of Oldbury, Birmingham ... £1,283

BRUCE, DAVID, managing director of British Polar Engines, Limited, Glasgow, until 1959, when he became deputy chairman of Associated British Engineering, Limited, the parent company ... £17,604

Obituary

Former cashier at Ramsay Colliery (Midlothian), Mr. WILLIAM PEACOCK died on Thursday of last week.

Engineering foreman at the Sutton-in-Ashfield works of Sheepbridge Stokes, Limited, cylinder casting manufacturers, etc., of Chesterfield, Mr. FREDERICK COLLEY has died at the age of 48.

Mrs. JANE WILSON, a founder and director of Wilson & Jubb (Leeds), Limited, lead smelters and manufacturers, of Leeds, has died at the age of 79.

Former progress manager of the Chesterfield Tube Company, Limited, Mr. EDWIN MITCHELL has died at the age of 80. He was associated with the company for 41 years.

For 37 years managing director of Daniel Foxwell & Son, Limited, textile machinery manufacturers, of Cheadle (Cheshire), Mr. Derrick Foxwell has died at the age of 70.

The death has occurred of Mr. NEVILLE G. BARRACLOUGH, formerly chief engineer of the Workington Iron & Steel Company, branch of the United Steel Companies, Limited. He was 78.

The death has occurred of Mr. H. BASIL DARBY, chairman of Darby & Company (Birmingham), Limited, iron and steel merchants, and a past president of the Foundry Coke Merchants' Association. He was 69.

Former president of the Derbyshire Miners' Association, Mr. SAM GREENHOUGH has died at the age of 80. A colliery checkweighman, he was secretary of the South Wingfield branch of the National Union of Mineworkers for 45 years.

The death has occurred at the age of 91 of Mr. HERBERT KENWORTHY, who had been chief buyer with the Lilleshall Company, Limited, structural engineers, agricultural implement manufacturers, etc., of Oakengates (Salop), for 40 years when he retired in 1949 after over 60 years' service with the company.

Former steel allocation manager of Brown Bayley Steels, Limited, Sheffield, Mr. ALBERT FLINT died last week at the age of 82. He worked for Brown Bayley Steels for 35 years before his retirement and before that he was a skilled silversmith. His work brought him into close contact with Mr. Harry Brearley, the discoverer of stainless steel. During the war he was chief inspector of the company's aeronautical inspection department. He was for many years secretary of the Sheffield Arts and Crafts Guild and was made MBE in 1952.

NUM Replies to "Rebel" Winders

LEAFLETS opposing those issued by the "rebel" National Union of Pit Winding Enginemen have been published by the National Union of Mineworkers. The letter is signed by the general secretary of the NUM, Mr. Will Paynter, and is understood to have been circulated to winding houses in most coalfields.

Mr. Charles Guest, temporary secretary of the new union, said that the interest shown in it had exceeded all expectation.

Cllr. Ezra Wood, vice-president of the executive committee of the Amalgamated Central Association, has appealed to all pit deputies, colliery overmen, and shotfirers in the Nottingham and north-east Derbyshire Areas to join the deputies' "rebel" organization, "so that we can have a strong representative union."

With a present strength of 285, a mass meeting is to be held at Mansfield (Nottinghamshire), in a fortnight's time to recruit more members.

NEWS IN BRIEF

AN OFFICE has been opened by Ambuco, Limited, at 158, Bath Street, Glasgow, C.2, and Dron & Dickson, Limited, of the same address will act as its representative in Scotland.

STEEL industry at Tsingtau, on the east coast of China, is to be expanded by the construction of a rolling mill. Most of the steel produced in the region goes to local industry.

BALL-BEARING PLANT with a capacity of 9,000,000 ball-races a year is to be built at Kilce, Poland. The plant, to be completed by 1965, will specialize in types at present imported by Poland.

SUBSIDIARY COMPANY in Argentina has been formed by Joseph Lucas (Industries), Limited, in conjunction with an Argentine company, Siam Di Tella. The subsidiary will be known as Tem-Lucas.

OVERTIME WORKING at the Sheffield cutlery firm of Viners, Limited, enabled sufficient cutlery to be flown out for guests attending the recent banquet given to the Queen and the Duke of Edinburgh by the King of Nepal.

SOVIET UNION has agreed to help India expand production of the Soviet-built steel plant at Bhilai to 2,500,000 tons a year during the next five years. The plant has an annual output of 1,000,000 tons at present.

DEGREE COURSE in refractories and ceramics technology is to be pioneered by Sheffield University, which is unique in having a department of refractories technology. The new course is expected to take three years to complete.

RECENTLY-FORMED Indian company, Permanent Magnets, Limited, is erecting a production unit at Borivili, near Bombay, with an annual capacity of 180 metric tons of permanent magnets—enough to cover India's whole requirement.

MEXICAN CONCERN, Altos Hornos de Mexico, SA, is to spend 168,000,000 pesos this year on extending its steelworks capacity by about 1,000,000 metric tons. Further investment is planned to reach a capacity of 1,250,000 tons by 1965.

President of the Newcastle-upon-Tyne branch of the Iron, Steel and Metal Dressers' Trade Society, Mr. W. TURNER, has been elected secretary of the society's north-east district. He also serves on the national executive committee.

AT THE STEEL MILLS of Stewarts and Lloyds, Limited, near Mossend (Lanarkshire), the No. 1 mill has temporarily ceased production. It is hoped that when several orders have been secured in the next week or two, it will be possible to resume limited production.

MEMBER COUNTRIES of the European Coal and Steel Community are being asked by the High Authority for details of all freights charged for carrying coal and steel in the community. This is said to be the first step towards achieving comparable rates for all consumers.

SUMMARY of the work and expenditure of the Monopolies Commission during 1960 is contained in the Board of Trade's annual report on the operation of the Monopolies and Restrictive Practices Acts, 1948 and 1953, which was published by the Stationery Office on Monday.

TO DEAL WITH the marine propulsion engine side of the industry, the Ship and Boat Builders' National Federation has formed a separate body—the Marine Engine Manufacturers' Association. Membership is open to any company making marine propulsion units and to companies engaged in the sale of British or foreign marine propulsion units as sole UK concessionaires.

RECORD CARGO of 35,000 tons of iron ore, expected at Tyne Dock on Tuesday aboard the Liberian carrier Ore Meriadian, will not be unloaded at the ore quay as planned since four large cargoes, including 30,000 tons in the Ore Regent, are due at the quay during the same week.

BY THE END of last year, about 97 per cent. of capacity in the Italian steel industry was being used, compared with 80 per cent. two years ago. The industry last year had the record steel output of 8,200,000 metric tons, and expects to produce 11,000,000 tons a year by 1964.

NEW COMPANY, Stanton & Staveley Sales, Limited, has been incorporated to handle all sales on behalf of the Stanton Ironworks Company, Limited, the Staveley Iron & Chemical Company, Limited, and the Sheepbridge Company, Limited. The new company will start operating on July 1, 1961.

LOST-TIME ACCIDENT frequency rate at the Steel Company of Wales, Limited, rose from 1.00 to 1.56 in the steel division and from 0.52 to 2.18 in the tinplate division during January. The new work department of the SCOW steel division now has a record of 461 days without an accident.

IPSWICH BRANCH of British Insulated Callender's Cables, Limited, is moving to new and larger premises on March 13. The address will be 1, Benezet Street, Ipswich (telephone: Ipswich 57265). The present office in St. Peter's Street will close down on the same date. The branch continues under the management of Mr. L. de Wynter.

MINIATURE CUPOLA made by apprentices at Newton Chambers & Company, Limited, Thorncliffe, Sheffield, and installed by them at the new foundry training centre at Rotherham College of Technology, was officially handed over to the college authorities recently. The cupola has been operating at the college since the foundry training centre was opened a year ago.

OZD STEELWORKS, in Hungary, whose capacity has recently been increased to 600,000 metric tons of raw steel annually, is undergoing reconstruction. By mid-1962 eight oil furnaces equipped with electronic measuring instruments will replace the 12 existing furnaces each with a capacity of 60 tons. Steel production will eventually increase to 800,000 tons.

A PAPER ON "Reinforced Concrete in Mining," will be given by Mr. C. A. C. Davies, chief civil engineer of the National Coal Board, at a meeting of the Mining Society of Coalville (Leics), Mining and Technical College on March 23, at 6.30 p.m. A film on the sinking of Parkside Colliery will be shown. The meeting will be open to all interested to attend.

A CLASSIFIED EXHIBITION of books for industry will be held at the Engineering Centre, Stephenson Place, Birmingham, on Tuesday, Wednesday, and Thursday of next week. The exhibition will be open from 10 a.m. to 9 p.m. except on Tuesday, when it will be officially opened at noon by Dr. P. F. R. Venables, principal of Birmingham College of Advanced Technology.

PLANS TO IMPORT natural gas in liquid form from North Africa for domestic use in the UK may be considered soon by Mr. Richard Wood, the Minister of Power. Following a visit to French natural gas projects in the Sahara, Sir Henry Jones, chairman of

the Gas Council, said on Wednesday, he hoped to reach agreement on the scheme with two French companies.

EXECUTIVES FROM a wide range of industries, including steel, machinery, and cutlery, this week at Sheffield attended a three-day course of lectures on quality control organized jointly by the British Productivity Council and the Sheffield and Rotherham Productivity Council. Theme of the course is the use of statistics in producing more efficient and less costly methods of checking the quality of completed products.

ALL 22 MINERS who were working in a shaft of the Viking coal mine, near Terre Haute, Indiana, US, died in an explosion last Thursday. The cause of the accident is unknown, but the mine was to have been closed shortly because of fears that gas might have been seeping in from old workings. The Federal Mines Bureau, the miners' union, the owners, and the insurance companies are to carry out an investigation.

LIST OF SHIPYARDS to be invited to tender for the new Cunarder to replace the Queen Mary has been approved by the Ministry of Transport. They are: John Brown & Company, Limited; Fairfield Shipbuilding & Engineering Company, Limited; Swan, Hunter, & Wigham Richardson, Limited, and Vickers, Limited, who will make a joint tender; Cammell Laird & Company, Limited; and Harland & Wolff, Limited.

NEED for European countries to use advanced management techniques, such as operations research, mathematical statistics, logical analysis, and computer simulation, was emphasized by Mr. Michael McNamara, of Production-Engineering, Limited, on his return from a visit to the US, sponsored by the American Department of State and the Irish Scholarship Board, during which he studied these techniques.

TO HELP finance the construction and operation of a plant for the manufacture of special-purpose pumps, the International Finance Corporation is to invest $(US)210,000 in KSB Pumps, Private, Limited, Bombay, India. The new plant, to be built at Pimpri, near Poona, will have a production of 800 pumps a year and will cost $630,000. The principal shareholder in the Indian concern is Klein, Schanzlin & Becker, AG (KSB), of Frankenthal, Germany.

FIGURES ISSUED recently by the Ministry of Labour indicate a slight deterioration in the availability of manpower throughout the country. Unemployment during January and early February fell by 29,368—from 418,899 to 389,531. The decrease in unemployment and the rise in vacancies are both greater than the normal seasonal variation at this time of the year. The only area to show a rise in unemployment between January and February is the north Midlands. Vacancies increased in all areas except the Midlands, where they fell by 858.

STEETLEY'S 1961 PROSPECTS

RESULTS for 1961 of the Steetley Company, Limited, manufacturers of refractories, may not vary greatly from those of 1960, if the forecast of 24,000,000-25,000,000 tons of steel are produced, states Mr. N. M. Peech, the company's chairman.

In 1962, he adds, the company should have the benefits of increased magnesia production and a full year's operation of the additional brickworks capacity. The two chief items of capital expenditure, covering the extensions to the sea-water magnesia plant at Hartlepool, costing £3,000,000, and to the Worksop basic brickmaking plant, costing £675,000, are expected to be completed early in 1962 and in the third quarter of 1961 respectively. Capital expenditure totalled £1,378,848 in 1960.

Appointments

Mr. W. CLARKE has been appointed shipping and traffic manager of the Perkins, Limited, group. He is succeeded as assistant company secretary by Mr. H. J. Wynne.

Mr. E. B. BROTHWOOD, staff officer with Newton Chambers & Company, Limited, Thorncliffe, Sheffield, has left to take up an appointment with the North Central Wagon & Finance Company, Limited, Rotherham.

Mr. DAVID W. SINCLAIR, secretary of Sheepbridge Company, Limited, iron and steel makers, of Chesterfield, who has been with the company for the past 17 years, has been appointed secretary of Tubewrights, Limited.

Member of the mining staff of Mavor & Coulson, Limited, since 1946, Mr. STANLEY WHITEHOUSE has been appointed district manager in Lancashire, North Wales, and the west Midlands for sales and service of the firm's underground equipment.

Following the separation by the West Midlands Divisional Coal Board of the retail sales and transport management functions of the marketing department, Mr. H. W. DAVIES has been appointed divisional retail sales manager with effect from a date to be agreed. For the past two and a half years he has been divisional transport and retail sales officer.

Mr. J. C. ROBERTSON, previously London branch manager of Johnson & Phillips, electrical engineers and cable makers, of London, S.E.7, has been appointed home sales manager. He is succeeded as London branch manager by Mr. R. A. JONES. Mr. R. L. STANLEY becomes plant sales manager. Mr. B. E. LEESON, having reached retiring age has, at his own request, been relieved of his sales management duties, but continues in a senior sales capacity relating to the sale of switchgear in certain areas.

Manager of Rawdon Colliery since January, 1960, Mr. ARTHUR SUMMERS has been appointed agent/manager of Donisthorpe Colliery, in succession to Mr. L. R. WATKIN, who has become a group manager in No. 4 (Huthwaite) Area of the East Midlands NCB. Mr. Summers worked underground at Donisthorpe from 1938 to 1945 and later became an underofficial with Moira Colliery, Limited. In 1953 he was appointed under-manager at Rawdon, becoming manager at Merrylees Colliery three years later.

New Company will Promote Middle East Trade

BELIEVED to be the first of its kind, a new company, to be known as the Middle East Association, is to be formed to promote trade with the Middle East. Many of Britain's leading industrial organizations have offered their support and the first formal meeting of the executive committee will be held on Monday.

The association's members will include Associated Electrical Industries, Limited; British Insulated Callender's Cables, Limited; English Electric Company, Limited; Ferranti, Limited; General Electric Company, Limited; Guest Keen & Nettlefolds, Limited; Imperial Chemical Industries, Limited, and Richard Thomas & Baldwins, Limited.

HUMPHREYS & GLASGOW, LIMITED—Mr. J. Solbett and Mr. D. Lennon have been appointed associate directors.

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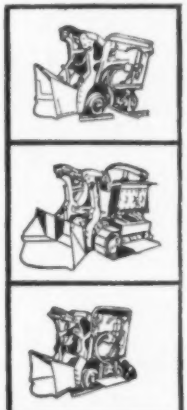

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P3460

"Suicide" To Raise Price of Coal Further

WITH oil "waiting to pounce" on any markets where coal's grip loosens, to charge more for coal would be suicide, says Mr. Alfred Robens, chairman of the National Coal Board, writing in Coal, the miners' magazine. Referring to the recent wage increases, which will cost the NCB £10,000,000, Mr. Robens says: "If the price of coal goes up, oil will be in and we shall be out, and we want no more contraction in this industry."

The only way to pay for higher wages, he says, is by greater efficiency, and the whole future of the industry depends on the ability to keep output per manshift rising. Because the board had complete confidence in the industry's growing efficiency, it had no hesitation in agreeing to wage increases, but to some extent it had earmarked benefits of future improved efficiency to meet the bill, as "an act of faith in our ability to win through to higher productivity together."

Mr. Robens warns that piece rates cannot rise as fast as OMS, because the benefits of improved productivity have to pay for other things besides higher wages, including the cost of the machinery itself to make higher productivity possible. The board was planning to introduce more and more machines, providing less arduous and safer working conditions. There will be greater concentration of working—fewer faces in some pits, but each producing more coal than before, and more faces will get coal on two or even three shifts instead of just one.

"I have no doubts whatever," Mr. Robens concludes, "that between us we've got all to make this industry successful and prosperous—and that means security and prosperity for all those who work in it." The article is the first of a series of monthly messages in the magazine which Mr. Robens plans to write to give miners information about important developments in the industry.

North-Western NCB's Recruiting Drive

MORE vacancies for boys in Lancashire and North Wales pits—and more opportunities for craft apprenticeships—are being offered by the North-Western Divisional Coal Board which has launched a recruiting drive to attract Easter school-leavers. Several hundred are wanted to help reach a target of 1,900 this year. The number includes 300 vacancies for craft apprenticeships in mechanical and electrical engineering—double last year's intake.

To cope with the increasing numbers, a training centre at Wigan Junction Colliery, Abram, near Wigan, is being reopened after Easter. A Divisional spokesman said today:—"We need physically fit boys between 15 and 17½ who want to train to do a man's job in an industry which will provide Britain's main source of power and which will remain the largest single employer of labour in the North West for many years to come. The increase in the number of apprentices is an indication of the growing mechanisation of coal mining."

Increases of Capital

LONGFORD WIRE COMPANY, LIMITED, increased by £30,000 in £1 ordinary shares, beyond the registered capital of £200,000.

PADLEY & VENABLES, LIMITED, Sheffield, increased by £150,000 in 1s. ordinary shares, beyond the registered capital of £200,000.

LEYLAND METAL COMPANY, LIMITED, Preston (Lancs), increased by £1,000 in £1 ordinary shares, beyond the registered capital of £500.

AIRSCREW COMPANY & JICWOOD, LIMITED, increased by £850,000 in 2s. ordinary shares, beyond the registered capital of £750,000.

COVENTRY APEX ENGINEERING COMPANY, LIMITED, increased by £3,000 in £1 ordinary shares, beyond the registered capital of £2,000.

MIDLAND STAMPING COMPANY, LIMITED, Stourbridge, increased by £100 in £1 ordinary shares, beyond the registered capital of £10,000.

APPARATUS & INSTRUMENT COMPANY, LIMITED, London, W.C.2, increased by £2,500 in £1 shares, beyond the registered capital of £2,000.

BRISTOL TOOL & GAUGE COMPANY, LIMITED, increased by £50,000 in £1 ordinary shares, beyond the registered capital of £5,000.

A. TAYLOR & SON (LEEDS), LIMITED, sheet metal workers, etc., increased by £20,000 in £1 shares, beyond the registered capital of £10,000.

PORTSMOUTH STEEL COMPANY, LIMITED, London, E.C.2, increased by £75,000 in £1 ordinary shares, beyond the registered capital of £25,000.

RICHARDSON ENGINEERING (BIRMINGHAM), LIMITED, increased by £10,000 in £1 ordinary shares, beyond the registered capital of £10,000.

ROTHER IRONWORKS, LIMITED, Rye (Sussex), increased by £5,000 in £1 ordinary shares, beyond the registered capital of £15,000.

A.B. METAL PRODUCTS, LIMITED, London, N.W.1, increased by £100,000 in £1 ordinary shares, beyond the registered capital of £150,000.

CADMIA ENGINEERING, LIMITED, Brightlingsea (Essex), increased by £4,900 in £1 ordinary shares, beyond the registered capital of £100.

PROGRESS WELDING COMPANY, LIMITED, Bilston (Staffs), increased by £4,000 in £1 ordinary shares, beyond the registered capital of £1,000.

UNIVERSAL ENGINEERING COMPANY (WILLENHALL), LIMITED, increased by £8,000 in £1 ordinary shares, beyond the registered capital of £12,000.

C. E. WELSTEAD, LIMITED, metal workers, etc., of Croydon, increased by £26,000 in £1 ordinary shares, beyond the registered capital of £52,000.

RENAULT MACHINE TOOLS (U.K.), LIMITED, Shrewsbury, increased by £80,000 in £1 ordinary shares, beyond the registered capital of £20,000.

CAM GEARS, LIMITED, engineers, etc., of Luton (Beds), increased by £925,000 in £1 ordinary shares, beyond the registered capital of £200,000.

VILLIERS ENGINEERING COMPANY, LIMITED, Wolverhampton, increased by £500,000 in 5s. ordinary shares beyond the registered capital of £1,750,000.

FORDHAM PRESSINGS, LIMITED (formerly Fordham (Holdings), Limited), sanitary engineers, etc., of Wolverhampton, increased by £99,900 in £1 ordinary shares, beyond the registered capital of £100.

ELAND ENGINEERING COMPANY, LIMITED, Kingston-on-Thames, increased by £8,000 in 150 ordinary and 7,850 6 per cent. non-voting preference shares of £1 each, beyond the registered capital of £2,000.

L. STERNE & COMPANY, LIMITED, manufacturers of gas engines, refrigerators, machinery, etc., of London, S.E.5, increased by £460,000 in 5s. ordinary shares, beyond the registered capital of £840,000.

SPENCER WIRE COMPANY, LIMITED, London, E.C.4, increased by £226,000 in 60,000 cumulative preference and 166,000 non-cumulative 2nd preference shares of £1 each, beyond the registered capital of £24,000.

SPENCER WIRE COMPANY (STEEL), LIMITED, Leeds, increased by £14,000 in 4,000 cumulative redeemable participating 1st preference and 10,000 ordinary shares of £1 each, beyond the registered capital of £1,000.

K.G. (HOLDINGS), LIMITED, London, W.1, increased by £500,000 in 100,000 7½ per cent. cumulative preference shares of £1 and 8,000,000 ordinary shares of 1s. each, beyond the registered capital of £500,000.

MIDLAND EXPANDED METAL COMPANY, LIMITED, Wakefield, increased by £1,500 in 1,000 cumulative redeemable participating preference and 500 ordinary shares of £1 each, beyond the registered capital of £2,000.

SPENCER WIRE COMPANY, LIMITED (formerly Self Sentering Expanded Metal Company, Limited), London, E.C.4, increased by £4,000 in £1 cumulative redeemable participating preference shares, beyond the registered capital of £20,000.

HECLA MANUFACTURING COMPANY, LIMITED (formerly Municipal Appliances Company, Limited), manufacturers of engines, boilers, etc., of Preston (Lancs), increased by £10,200, in £1 ordinary shares, beyond the registered capital of £50,000.

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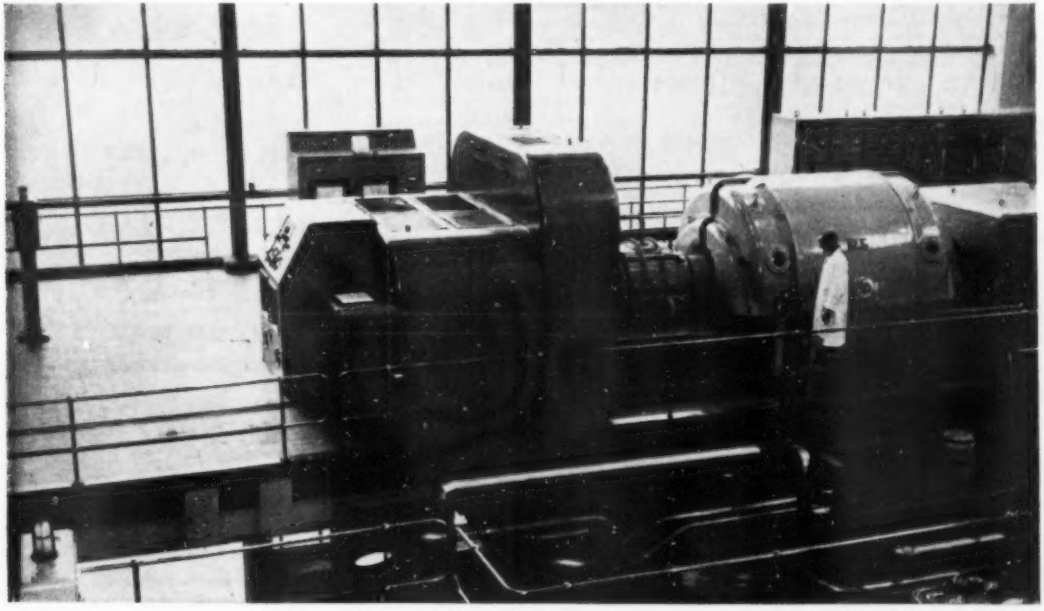

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Advertisements accompanied by a remittance and replies to Box Numbers should be addressed to the Advertisenent Manager, Iron and Coal, John Adam House, 17/19, John Adam Street, London, W.C.2. If received by first post Tuesday, they can normally be accommodated in the next Friday's issue.

SITUATIONS WANTED

SENIOR REPRESENTATIVE, 42, with 10 years successful selling to N.E. Iron and Coal trade, seeks change. Good engineering connections, sound working knowledge underground mining procedure. All replies considered. Driver's licence. Box SR388, IRON AND COAL.

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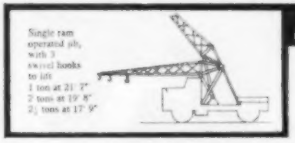

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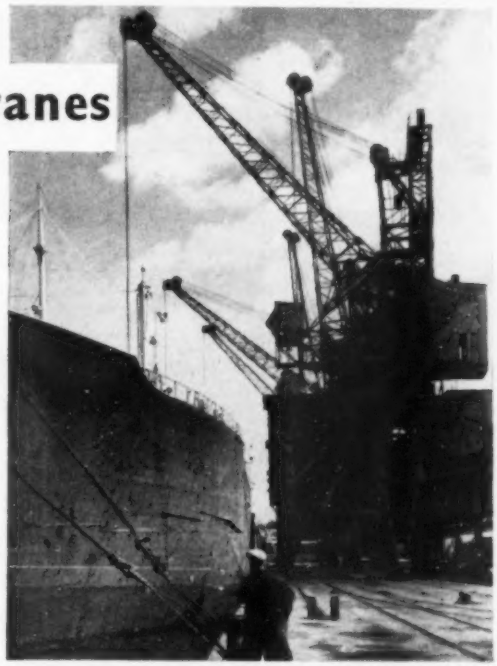

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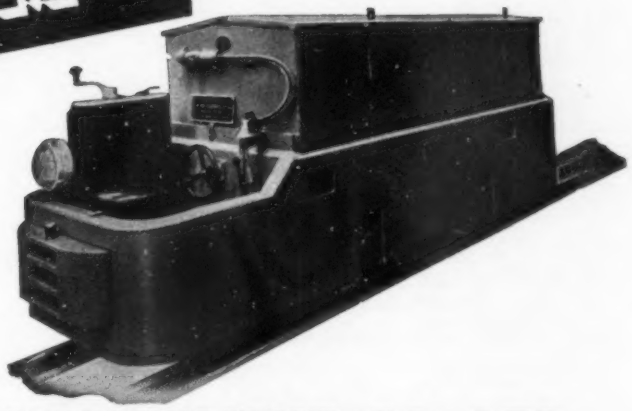

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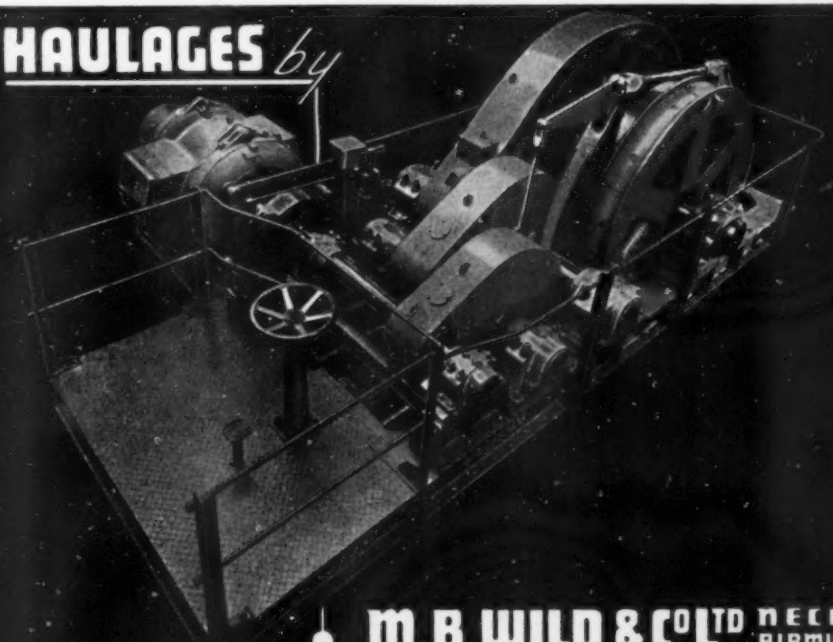

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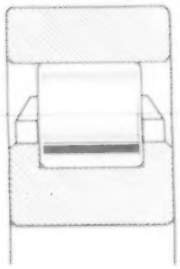

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